

# How to..

**A collection of some guidelines  
for civil engineering constructions**

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Eng .Indika WSP Yapa**

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#### Other books by the author

- Adjudication and arbitration, Volume 1 of 2 – [Buildings & Water works] 04 Case studies of Disputes
- Adjudication and arbitration, Volume 2 of 2 – [Road works] 09 Case studies of Disputes
- Technical and contractual issues and the engineer's decisions [views]—[road work related]
- Publisher Sihela time and space No 616, Makola North, Makola; Available for sale at Sarasavi book shop and IESL library

#### Books for General reading

- Maga kathawa – a story of site life of a Resident Engineer in Sinhala - e book
- Uthuru palathe da seawayata paminiyemi – day to day life experiences in northern province as the Resident Engineer, in Sinhala - e book
- Haththawiya ikmawiya – parikalpanaya wenas wiya – Thoughts of an old man on matters experienced at the time of writing, in Sinhala – e book
- Bale asu dutu katha ha charitha – a recollection of memories as a juvenile living in Mathara district in nineteen fifties, in Sinhala - e book

## Foreword

This book contains guidance given to my staff at different projects and my lectures at different institutions since 2000.

Some engineers, who worked with me years ago, suggested transferring my experience, to the new generation of engineers in some form. In my view, easiest is in the form of a book.

I felt it suitable to collect these old writings as a book and let others share my views, as I may not be associating younger engineers at work, when I decided to stop working as an engineer on reaching seventy five years of age.

Mr. Indika WSP Yapa - my latest companion in materials engineering aspect of a project, contributed in preparations of Quality Assurance plan, Method Statement(s) and Completion Report chapters. Mention should be made here of Mr. Wimal Silva another of my associates from the field of materials engineering, since I was a trainee in Road Research Laboratory in Ratmalana in 1970, in giving me electronic copies of sample QA manual and method statement.

### **Contents in this book do not belong to me.**

I believe knowledge belongs to the human kind, but not to some individuals. Knowledge is a collection of data and the lessons learnt through experience - mainly trial and error. Anyone considered knowledgeable is one who has collected knowledge -by his own errors, from others, by observing other's mistakes or from books written by persons before him. So, no one can own or sell knowledge. The right of a person is only to ask for some remuneration for the effort and time spent to impart one's knowledge to others. **There is nothing called patent right though the society accepts so.**

Any person can use the contents in this book but should not sell

It will be my pleasure if this book is of any use to any Sri Lankan Engineer as the contents are discussed with respect to Sri Lankan construction industry background.

My gratitude and respect are extended to **all my superiors** and others who helped me to gather knowledge and experience in numerous ways in various projects

**My thanks are extended to Eng. [Dr.] S.B. Wijekoon, who willingly accepted to read the first script, suggest improvements and wrote the preface**

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## **PREFACE**

This book assumes a knowledge of Practical Contract Management for the use of Civil Engineers, those who are appointed to administer construction contracts. The book consists of number of guidelines prepared based on the author's vast experience in the field of Civil Engineering Construction with special emphasis on road construction.

Chapter one of the book specifies how a construction contract should be started from the award of the contract, highlighting the activities to be initiated in a chronological order. Also, the chapter elaborates important clauses of the Conditions of the Contract and Specifications. Special consideration is given for selection of materials conforming to the Specification and their tolerances.

Chapter two of the book explains the effective planning required to administer a contract including pre- tender and post- tender planning. The chapter also elaborates the points to consider when planning a construction contract highlighting the importance of the Critical Path.

Chapter three of the book highlights three main hurdles during administering a contract as Internal Hurdles, External Hurdles and Contractual Hurdles. Also, the chapter explains how these hurdles are managed effectively in delivering a construction contract.

Some guidance to effectively administer a contract is explained in Chapter four of the book and these guidelines are linked with CIDA (former ICTAD) Conditions of Contracts for better understanding.

Chapter five of the book explains the role of the Engineer in administering a construction contract based on the CIDA (former ICTAD) and FIDIC (MDB version) of the Conditions of Contracts.

Most of the construction contracts executed in Sri Lanka are followed with a Quality Assurance system (QA) and knowledge of QA system is very important for the Engineers who administer construction contracts. Chapter six of the book describes how a Comprehensive Quality Assurance plan is prepared for a construction contract.

Chapter seven of the book explains important points to be considered when preparing a Method Statement.

The supervision aspect of a construction contract is very important for effective delivery of the contract. The author highlights the important points to be considered when supervising a contract during construction stage. Chapter eight of the book provides a guideline for the preparation of a Supervision Manual for the use of the supervising engineers.

The number of Construction Claims are increasing rapidly in construction contracts and their success is mainly dependent on the preparation of a 'Comprehensive Claim' including all the information, evidence and documents. Chapter nine of the book has proposed criteria / format for preparation of good Construction Claims under FIDIC Conditions of Contract for their success.

Preparation of a Completion Report is important at the end of the Project. A Guideline to prepare a satisfactory Completion Report is given in chapter ten of the book.

This book gives a systematic guide to administer construction contracts covering all major aspects. The book is very useful for both senior and junior engineers - those who administer construction contracts to deliver projects in an effective and an efficient manner without any major issues.

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## Chapter 1 - How to start construction of a [road] project from award

*[Based on FIDIC General conditions of contract and ICTAD General Specifications for roads]*

### A. Actions required

1	RECEIPT OF ACCEPTANCE LETTER FROM THE EMPLOYER					
2	SUBMIT (a) Performance bond; (b) Construction program with resources schedules, monthly cash flow forecast,					
3	Insurance policies, Mobilization advance guarantee, QA plan, Safety plan, Environmental mitigation plan and Method statement					
4	Introduction /approval of key-staff	Possession of site	Agreed date of commencement		Mobilization – office, accommodation, stores, laboratories	
5	Identification of material sources	Establishment of TBM & control points	Topography of road corridor – existing levels of road C/S survey	Engineer's and Employer's facilities	Property condition survey with photos /video	Joint inspection for Accesses and culvert / bridge
6	SUBMIT (b) <ul style="list-style-type: none"> <li>- source approvals of materials</li> <li>- photos /video of site showing private properties before construction</li> <li>- seek official approvals of joint inspections done</li> <li>- annual rainfall figures of the closest rain gauge station</li> <li>- Initial testing or identification of water/ air [/sound] pollution status before construction starts, as required in EMP given in the contract *</li> </ul>					

7	Submission and approval of construction drawings and detailed method of construction for complex works- DBST, Asphalt paving, bridge construction [separately for each bridge], to suit the construction program submitted					
8	Construction as per program	Requests for inspection and acceptance	QC test reports and frequency testing	Accident reports	Machinery movements	Site closure and other special events
9	Monthly submissions	Interim payment applications [IPA]		Progress photos	Progress reports	Environmental mitigation reports
10	Claims			Claim notices Claims proper		
11	Request for taking over	Tests on completion, if any		Release of retention	Completion of outstanding defects and remedying any new defects shown	
12	Statement at completion					
13	Defects correction during the defects notification period					
14	Request for completion certificate and submitting final claim					
15	Employer’s claims and third- party claims					
16	No claim certificate					



## **B. Relevant contract sub clauses for action**

1. Letter of Acceptance- sub clause 1.1.1.3 – Definition
2. Submit
  - 2.1. Performance security – Sub Cl. 4.2;
  - 2.2. Construction program – Sub Cl. 8.3
  - 2.3. Contractor’s representative- Sub Cl. 4.3
  - 2.4. Method of construction – Sub Cl. 4.1 [para 5]
3. Submit
  - 3.1. Insurance – Sub Cl. 18
  - 3.2. Mobilization advance Sub Cl. 14.2
  - 3.3. QA plan- Sub Cl. 4.9
  - 3.4. Safety plan- Sub Cl. 4.8
  - 3.5. Environment safety plan Sub Cl. 4.18
4. Initial correspondence with the Employer/Engineer
  - 4.1. Key staff – [This requirement of approval comes only in particular conditions] Staff in general is under Sub Cl. 6
  - 4.2. Possession of site- Sub Cl. 8.1( c ) & 4.13
  - 4.3. Date of commencement Sub Cl. 8.1
  - 4.4. Mobilization of housing, office, yards, lab, etc. – Sub Cl. 6.6, 6.7, 6.10, 6.11, 6.13, 6.14, 6.15, 6.16, 6.17, & 6.18, and 4.14, 4.15, 4.19 & 4.23
5. Initial works before construction
  - 5.1. Establishment of control points and TBM –Sub Cl. 4.7
  - 5.2. Surveying & leveling–Sub Cl. 4.7 [contract includes specifications]
6. Initial approvals
  - 6.1. Source approvals of materials- Sub Cl.7, 3.3 & 4.1 [contract includes specifications]
  - 6.2. Photos/video of site before construction [not a requirement but will help for situations under these] Sub Cl. 17.1 & 17.2
  - 6.3. Seek official approvals of joint inspections done- Sub Cl. 3.3 (a) & (b)
  - 6.4. Annual rain fall figures of the closest rain gauge station- Sub Cl. 8.4 ( c )
  - 6.5. Initial testing or identification of water/ air sound pollution status- Sub Clause 4.18
7. Construction drawings- Sub Cl. 4.1
8. Construction approvals
  - 8.1. Request for inspection and acceptance- Sub Cl. 3.3 & 4.1
  - 8.2. QC test reports & frequency testing- Sub Cl. 3.3, 4.1 & 4.9
  - 8.3. Accident reports- Sub Cl. 4.8
  - 8.4. Machinery movement- Sub Cl. 4.17

8.5. Site closure and any other special event Sub Cl. 6.5 [also required for requests under 8.4 and 8.6]

9. Monthly Submissions

9.1. Interim Payment Application [IPA] - Sub Cl. 4.17

9.2. Progress reports- Sub Cl. 4.21

9.3. Progress photos- Sub Cl. 4.21

10. Claims

10.1. Claim notice- Sub Cl. 20. 1. [and any other clause under which the entitlement is based such as delay in possession of site; late instructions; substantial change of quantities; change of scope of work requiring different equipment, new materials, or new methods or rare to find skills; unusual weather; force majeure'; unforeseen physical conditions; subsequent legislation]

10.2. Claim proper – Sub Cl. 20.2 & 3 note the time limit

11. Completion and handing back

11.1. Employer's taking over- Sub Cl. 10

11.2. Tests on completion- Sub Cl. 9

11.3. Release of retention- Sub Cl.14.9

11.4. Completion of outstanding defects & remedying defects Sub Cl. 11.1

12. Statement at completion – Sub Cl.14.10

13. Defects correction during defects notification period- Sub Cl. 11

14. Request for performance certificate and final claim- Sub Cl.11.9; 14.12 & 14.13

Note: All clauses are not considered here. What the Construction Manager should know under normal circumstances are only listed

## C. Relevant specification clauses for actions

### Relevant specification clauses

The **easiest way to refer to specifications** is to **refer to BOQ item**. In the vertical column -pay item, relevant specification number can be easily found. It should be noted that there are items that need be attended by specification without a pay item in BOQ. Such should be referred to by common sense and reading the specification book for the required works beforehand.

1. Items in preliminaries
  - 1.1. Insurance –
  - 1.2. QA plan-
  - 1.3. Safety plan-
  - 1.4. Environment safety plan [not in all contracts]
  - 1.5. Engineer's and employer's facilities
2. Surveying [clause 117 very brief]
  - 2.1. Establishment of control points and TBM
  - 2.2. Surveying & leveling

For these items general specification does not give full requirements as they vary with the contract. **All such items are given in particular specifications**

3. Specification - main clauses
  - 3.1. Earthworks- clause 300
  - 3.2. Base(s) and sub bases- clause 400
  - 3.3. Surfaces – clause 500
  - 3.4. Drainage-clause 700
  - 3.5. Incidental construction – clause 800
  - 3.6. Bridges and other structures- clause 1000
  - 3.7. Quality control- clause 1600
  - 3.8. Material details – clause 1700
  - 3.9. Tests for QC of materials & works – clause 1800 [testing standards only]
  - 3.10. Site investigations – clause 1900
  - 3.11. Geo-synthetics- clause 2000
4. Source approvals
 

Initial approvals of materials are two types for naturally occurring materials and manufactured materials.

Manufacturer's certificate or meeting SLS or BS standards [proof not older than 3 months will be accepted] are enough to be **accepted for purchase** but a sample from stocks

  - Should be taken with the Engineer's representative tested in a recognized independent laboratory for records.
  - Naturally occurring [site made] materials should be,
  - Good, by nature- inherent properties
  - Good after production- made shape or properties

#### 4.1. Manufactured materials

Material	Specification					Remarks
	Clause	Type	Standard	Property	Standard tests	
Cement	1703	Ordinary Portland	SLS107	Fineness	SLS107 app. A	Done at major recognized laboratories
				Chemical composition	SLS107 app. C/D	
				Compressive strength	SLS107 app. C /D	
				Setting time	SLS107 app. F	
				Soundness	BS 4550	
		Blended hydraulic	SLS 1247	Pozzolana		
		Portland limestone	SLS 1253-2008	Not used for sub structure. A low-grade cement, not resistant to acidic conditions		
		Rapid hardening	BS12 or BS EN 197-1	For under water concretes		
		Sulphate resisting	ASTM C150; BS 4027	For sub structures in corrosive environment		
Masonry	SLS 515	Masonry only; not to be used in concrete				

Material	Clause	Type	Standard	Property	Standard tests	remarks	
Steel r/f	1002	Cold worked high yield [TOR]	SLS 375	Tensile strength 460 N/mm <sup>2</sup>	Yield strength; Elongation <12%;	Done at major recognized laboratories	
		Hot rolled Mild	SLS 26	Tensile strength 250 N/mm <sup>2</sup>	Weight of unit length; Re-bending test;		
Bitumen	1702.2	Cut back MC 30	ASTM- D 2027	Residue from distillation heated to 260 °C >50%		Done at major recognized laboratories Spec. 1802.2	
		MC 70		Residue from distillation heated to 260 °C >55%			
		MC 250		Residue from distillation heated to 260 °C >67%			
			Refer appendix 501.1 on preparation of cutback bitumen				
	1702.3	Emulsion CSS-1	ASTM–D 2397	Separate ASTM Designated tests are there for Viscosity;		Done at a major recognized laboratory Spec. 1802.3	
		CSS-1h		Settlement; Storage stability; Particle charge test; Sieve test; Distillation characteristics; Residue of distillation			
		CRS -1					
		CRS- 2					

Material	Specification					Remarks
	Clause	Type	Standard	Property	Standard tests	
Bitumen	1702.1	Penetration grade 80/100	ASTM–D 5-97, 36-95, 6-95, 92-96, 2042-93 respectively	Penetration;	80 – 100	Done at a major recognized laboratory Spec. 1802.1
				Softening point;	47 -55	
				Heating 5 hrs. @163 °C		
				1. Loss of weight %;	<=0.5	
				2. Loss in penetration %;	>= 80	
				Solubility;	>= 99.5	
				Flash point;	>= 232	
		Penetration grade 60/70	ASTM–D 5-97, 36-95, 6-95, 92-96, 2042-93 respectively	Penetration;	60–70	
				Softening point;	48 -56	
				Heating 5 hrs. @163 °C		
				1. Loss of weight %;	<= 1	
				2. Loss in penetration %;	>= 75	
				Solubility;	>= 99	
				Flash point;	>= 232	

Material	Specifications					Remarks
	Clause	Type	Standard	Property	Standard tests	
Geo-textiles	1710	Values are given in tables 1710 -1, 2, 4, 5 & 7				
	1710.6	For Subsurface drainage controls	ASTM – D 4491 4751 4355 respectively	Permittivity; Apparent opening size; Ultra violet stability;	Values are given in Table 1710-1 & 1710-2	Maximum average value for roll
	1710.1 & 7	As paving fabric	ASTM – D 4632 4533 4833 respectively	Grab strength; Sewn seam strength; Tear strength; Puncture strength;	Values are given for 3 classes in Table 1710-1	Minimum average value for a roll

#### 4.2. Naturally occurring [Site made] materials

Material	Specification					Remarks
	Clause	Type	Property	Requirement/ Value	Standard tests	
Embankment fill	1708.1	Type I	Liquid Limit	<50%	AASHTO- T90	Done in field lab at site
			Plasticity index	<25%		
			Max. Dry Density [modified]	1600Kg/m <sup>3</sup>	AASHTO- T180	
			4- day soaked CBR	<7%	AASHTO- T193	

Material	Specification					Remarks
	Clause	Type	Property	Requirement/ Value	Standard tests	
Embank- ment fill (contd.)	1708.1 (contd.)	Type II	Liquid Limit	<55%	AASHTO- T90	Done in field lab at site
			Plasticity Index	<25%		
			Max. Dry Density [modified]	1500Kg/m <sup>3</sup>	AASHTO- T180	
			4 day soaked CBR@95% MDD	<5%	AASHTO- T193	
Sub base	1708.2	Type I [upper]	Liquid Limit	<40%	AASHTO- T90	Done in field lab at site
			Plasticity Index	<15%		
			Max. Dry Density [modified]	1750 Kg/m <sup>3</sup>	AASHTO- T180	
			4- day soaked CBR@ 98% MDD	<30%	AASHTO- T193	
			Grading	Table1708-3		
		Type II	Liquid Limit	<40%	AASHTO- T90	Done in field lab at site
			Plasticity Index	<15%		
			Max. Dry Density [modified]	1650 Kg/m <sup>3</sup>	AASHTO- T180	
			4 -day Soaked CBR@ 95% MDD	<15%	AASHTO- T193	
			Grading	Table1708-1 under section1708-2		



Material	Specification					Remarks
	Clause	Type	Property	Requirement/ Value	Standard tests	
Shoulder and gravel surfacing	1708.5		Liquid Limit	<55%	AASHTO- T90	Lateritic soil in wet zone
			Plasticity Index	<4 to 25%		
			Liquid Limit	<50%	AASHTO- T90	Normal soil in wet zone
			Plasticity Index	<4 to 20%		
			Liquid Limit	<55%	AASHTO- T90	in dry zone
			Plasticity Index	<6 to 25%		
			4- day soaked CBR@ 100% MDD	<15%	AASHTO- T193	For all zones
			Grading	Table 1708-1 under 1708-5 section		All tests done in field lab at site
Aggregate (s)	1701.2	For concrete				
		Fine	Sodium Chloride	<0.10%	Not done commonly; but if sand point is closer to sea or streams of low flow hard water, this test is needed	Done at a major recognized laboratory
			Soluble Sulphates	<0.25%		
			Grading preferred	Table1701-2		
		Coarse	Sodium Chloride	<0.05%		
			Soluble Sulphates	<0.25%		

Material	Specification					Remarks
	Clause	Type	Property	Requirement/ Value	Standard tests	
Aggregate (s) (contd.)	1701.2 (contd.)		Aggregate impact value	<45%		Done in field lab at site
			Flakiness index	<35%	BS 812	
			Grading preferred	Table1701-1		
	1701.3	ABC [DGAB]	Aggregate impact value	<30%	BS EN 1097-2	Done in field lab at site
			Flakiness index	<35%	BS 812	
			Plasticity index	<6%	AASHTO- T90	
			4- day soaked CBR	>80%	AASHTO- T193	
			Grading	Table1705-1		
		Bound bases & surfacing	Los -Angeles Abrasion Value	<40%	AASHTO T- 96	Done at a major recognized laboratory
			Aggregate impact value	<30%	BS EN 1097-2	Done in field lab at site
			Flakiness index	<35%	BS 812	
			Water absorption	<2%		
			Coating & stripping	>95%	AASHTO T- 182	
			Loss on the sodium sulphate soundness test	<12%	AASHTO T- 104	Done at a major laboratory
			Grading	Table 506 -1		

Material	Specification					Remarks
	Clause	Type	Property	Requirement/ Value	Standard tests	
Aggregate (s) (contd.)			Los -Angeles Abrasion Value	<40%	AASHTO T- 96	Done at a major recognized laboratory
			Aggregate impact value	<30%	BS EN 1097-2	Done in field lab at site
			Flakiness index	<35%	BS 812	
			1701.3 (contd.)	Chips for surface dressing [seal coats]	AASHTO T-182	
					BS812; ASTM 88-83	Done at a major recognized laboratory
Asphalt	506	Binder course			ASTM D 244-99 / AASHTO T 245 [Marshall stability & flow]	Done in field lab at site
Asphalt (contd.)	506 (contd.)	Wearing course	Mix requirements	Table 506-1		Done in field lab at site
			Mix characteristics	Table 506-2 (b)	ASTM D 244-99 / AASHTO T 245 [Marshall stability & flow]	
			Permissible variations	Table 506-3		

5. Quality control, Tolerances and rectification Section 1600 of SCA- 5

5.1. Control of alignment, surface regularity, and pavement layer thickness-Clause 1601

5.2. General – Sub clause 1601.1

5.3. Horizontal alignment – Sub clause 1601.2

- 5.4. Longitudinal profile and pavement layer thickness- Sub clause 1601.3
- 5.5. Surface regularity of sub grade and pavement layers- Sub clause 1601.4
- 5.6. RECTIFICATION- Sub clause 1601.5

#### **WHY tolerance?**

1. The work is specified because it is what exactly expected is.
2. No work can be done perfectly and at every time.
3. Construction is not a simple, single, action. Many thousands of actions, by many numbers of people, in many hours, considered as many activities identified in a construction program are involved in constructing a road.
4. No person can do a perfect job of work. When different persons do similar works, they are not identical. When a group does things, differences are unavoidable.
5. So, an acceptable level has to be agreed. The acceptable level is, that one specified with the stipulated tolerance.
6. THEREFORE, TOLERANCE LIMITS SHOULD BE FOLLOWED VERY STRICTLY FOR A FINISHED JOB TO BE ACCEPTABLE.
7. If not? What shall be done? RECTIFICATION!!! - Please refer Sub clause 1601.5

#### **D. Tests**

- Earth for
  - Embankment type I & II
  - Sub base
  - Shoulder
- Rubble
  - Rock properties
- Aggregates for-
  - Concrete
  - Base [ABC]
  - Asphalt
  - Seals
  - Filter media
- Bitumen
  - Penetration grade
  - Cut back
  - Emulsion
- Cement Types
  - Ordinary Portland cement

- Sulphate resisting cement
- Rapid hardening cement
- Masonry cement
- Steel r/f
  - Mild & tor (refer to specification section 1002)
- Miscellaneous materials – Normally manufacturers' certificate is enough. Sometimes specific tests are requested. If so, testing has to be done at specialist laboratories such as ITI, NBRO, RDA Ratmalana, universities and some few private laboratories are now functioning in Colombo district.
  - Geo-textile
  - Gabion wires
  - Sign boards
  - Safety rails
  - Concrete pipes
  - Road paint/mastics
  - Road studs [reflecting]

## 1. Tests for works / materials and their significance

### 1.1. Embankment filling

1.1.1. Remove top soil & compact in-situ soil - 93% MDD of existing soil to be achieved- spec 304.3 ( c) if the fill depth of embankment is less than 500 mm this shall be 95%

A) Tests- Proctor test – BS1377 or AASHTO -T180 - field density [sand cone test]

- **Proctor test** is an indicative test for maximum density achievable when compacted using standard drop hammer on soil in a standard mould filled in 3 layers at the optimum moisture + or – 2%
- **Sand cone test** is to find the density of the compacted soil by excavating a hole of measurable shape, finding the volume by filling sand into the hole and weighing the removed soil and finding the field moisture to do the calculation

B) Significance-

- To compact fill- material it should be on firm ground;
- To achieve this 93 % of MDD of in-situ soil is considered adequate to fill with embankment material

1.1.2. Fill embankment in layers - Correct material should be selected; Filling should be in 200 mm layers should be compacted to 93% and top 150 to 95% MDD has to be achieved – Spec 304 .3 (e)

A) **Tests** to be done to select correct soil, are

- **Liquid Limit**- to ascertain water absorbing capacity going soft Plasticity Index- as an indication of binding property and change in volume in dry and wet conditions
- **Max. Dry Density** – an indication of strength of soil
- **4 -day soaked CBR@ 95% MDD**- indication of penetration of wheels under load in compacted soil under soaked conditions
- **Grading**- for a material that will compact and reduce voids under compaction

To ensure that material is well compacted

- Layer thickness is limited;
- Correct moisture level [+ or – 2% of optimum] is maintained field density tests are done

B) Significance

The filled layers form one mass of soil, as the particles are binding due to its binding properties; soil is compacted well so that the voids are minimized, thereby water absorbing is less; the wheels will penetrate less into the ground under the loads in wet conditions, because the material selected can stand such pressure

## 1.2. Sub base filling

Correct material should be selected; Filling should be in 225 mm layers [depends on compaction effort i. e. weight of machine, number of passes, vibration effectiveness] should be compacted to 98% upper one and lower one to 95% MDD has to be achieved – Spec 401.4 (c)

A) Tests to be done are

- Liquid Limit- to ascertain water absorbing capacity going soft
- Plasticity Index- as an indication of binding property and change in volume in dry and wet conditions
- Max. Dry Density – an indication of strength of material
- 4 -day soaked CBR@ 95% MDD- indication of penetration of wheels under load in compacted soil under soaked conditions
- **Grading**- for a material that will compact and reduce voids under compaction

To ensure - material is well compacted

- layer thickness is limited;
- Correct moisture level [+ or – 2% of optimum] is maintained field density tests are done

B) Significance - Same as for embankment

### 1.3. Base construction

Correct material should be selected; Filling should be in 200 mm layers minimum to be 75 mm, should be compacted to 98% MDD has to be achieved – Spec 405.3 (b)

#### A) Tests to be done

- Plasticity Index- as an indication of no clay/ plastic properties
- Max. Dry Density – an indication of strength of material
- 4- day soaked CBR@ 95% MDD- indication of penetration of wheels under load in compacted soil under soaked conditions
- Grading- for a material that will compact and reduce voids under compaction

To ensure material is well compacted

- Layer thickness is limited;
- Correct moisture level [+ or – 2%of optimum] is maintained
- field density tests are done

#### B) Significance - Same as for embankment

### 1.4. Prime coat

Correct material applied at planned rate at right temperature as required which will be in tact to receive surfacing material.

#### A) MC30 tested for residue from distillation heated to 260 C shall be >50% Tray test and site check of temperature

#### B) Significance - A cohesive crust of water seal to be formed

### 1.5. DBST -Double Bitumen Seal Treatment

Correct materials applied at planned rates at right temperature as required which will form a protection for the prime and is a wearing surface.

#### A) Tests done to select bitumen are

- Penetration - as an indication of density and viscosity
- Softening point – indication of viscosity Heating 5 hrs. @163 °C
- Loss of weight % - volatility
- Loss in penetration % - an indication of viscosity
- Solubility – make sure the bitumen can be removed for testing to check bitumen percentage [dissolving the material in trichloroethylene]
- Flash point – indication of burning temperature

Tests for selecting aggregates

- Los -Angeles Abrasion Value- abrasion due to traction
- Aggregate impact value – Hardness of aggregate on pounding effect

- Flakiness index - flat elongated chips are less
- DUST CONTENT [passing 75 µm sieve] - dust is less and chips will adhere to bitumen
- Coating & stripping - surface adhesion of bitumen on aggregate due

To surface charges of rock type and type of bitumen [cationic or Anionic]

- Loss on the sodium sulphate soundness- hardness of aggregate on chemical environment

Tests on application are

- Depot tray test - for uniformity of distribution across road;
  - Tray tests at random -to assess rate of application as actual for bitumen as well as chippings
- B) **Significance** - A layer that protects the prime coat from abrasion by wheel movement, non- skidding, lasting, uniform in texture, non-sticky [no bleeding] is expected of a DBST. The tests help to achieve these if the workmanship is good

#### 1.6. Asphalt wearing course

- A) In addition to test for aggregates, bitumen of penetration grade Marshall Test is carried out to design the mix and after paving, cores are taken and extraction test is done
- Thickness - thicker layers give better pavement strength (with limitations)
  - Compacted density- dense material is hard and can stand more pressure, has less voids
  - Bitumen content- bitumen binds materials together, if too much it flows out of the mixture (flushing/bleeding),
  - Voids in combined aggregates - (asphalt engineers' term Voids in Mineral aggregate VIM) allows bitumen to take inter space to fill and bind them together
  - Voids in the compacted mix – allows the asphalt to be flexible, slightly flowing but not deforming under the load adjust for movement of sub grade under load [compare a cushion and a rock!]
  - Marshall Stability – indicates whether stable under the load & long lasting [like the concrete crushing strength]
  - Marshall Flow -indicates whether flexible but not deform
- B) **Significance** - A layer that protects the prime coat from abrasion by wheel movement, non-skidding, lasting, flexible, non-moving under load or due to traction, not too rigid, non-sticky [no bleeding] is expected of asphalt wearing course. The tests help to achieve these if the workmanship is good.



## 1.7. Concretes

Cement tests

Aggregate tests

- Sodium chloride & soluble sulphates (– allowable maximum 0.10 & 0.25 %)
- Aggregate impact value – Hardness of aggregate on pounding effect
- Flakiness index - flat elongated chips are less
- Los -Angeles Abrasion Value- abrasion due to traction,
- Grading-particle size distribution to ascertain how well these will mix and reduce volume on compaction to form a solid mass with minimum voids

## 1.8. Frequency tests- Specification 1602.

- A) These are same as what has been discussed above. How often i. e. at what frequency these tests are to be carried out is given in a table in section 1602. So, they are commonly called frequency tests.

It may be required to do more frequently if change of properties is suspected or for change of material or its source of supply.

Note should be made “The **testing frequencies given in table 1602-1 are the MINIMUM and the Engineer may direct the contractor to carry out tests as frequently as he may deem necessary to satisfy himself that the material and work comply with the appropriate specifications.**”

- B) Significance - The construction process takes time and large quantities of material are required. Therefore, the material selection and storage are not done at one time. Properties of materials do change in different stocks whether factory made or naturally selected. Therefore, source approval has to be done **initially as well as during construction** for SELECTING RIGHT QUALITY MATERIAL.

***There are tests to be done to ensure quality of work done.***

These should be carried out,

- a) for the work done in a day,
- b) For a minimum quantity of work, if lot of work is done in a day.

Why?

1. Every day the working condition, the workers, the materials and the machinery may not be exactly the same. So all these can contribute to a change in the final quality as planned

2. Examples are; on very hot day the moisture on soil can be a bit low when taken from the heap as drying is fast and right moisture will be available for rolling. When water is sprinkled on spread soil sticking a thin layer in the roller is possible and will need a small hold up of rolling; The roller sent may not be the same and effective vibration will be different; the gang leader may not be the same and his concern of quality of final product will be less; After a heavy rain the water content in sand will be high and water to be added to the concrete mix if not very seriously adjusted, mix will be different; new loads may be added to the aggregate heap and there can be a change though not very big in the grading
3. When a big quantity is done for a day different gangs may be working; material may change in properties; machines may be different in performance

## DISCUSSION

1. Why do we select different layers for road construction?
  - 1.1. Wheels exert pressure on the road surface if stationary or slowly moving. When moving at a speed the wheels not only roll over the surface but make a small up and down motion. This gives a pounding action in addition to the pressure exerted. This will deform the earth surface if suitable action is not taken.
  - 1.2. Soil on earth absorbs water. Wet soil cannot stand the same pressure as dry soil. So, the road is raised above the ground so that water on the road after a rain will drain off it and in no time the road will be dry. This raised part of the road is called the platform.
  - 1.3. Till the water drains off, the road will be wet and wheels may go down into the surface. So, to have a road usable in wet conditions too, the road top is sloped cross wise and a non-absorbing surface is made on top. This is the bitumen or tar we see on a road unless it is a concrete surface.
  - 1.4. The weight of the vehicle is passed on to the road by the wheels. The contact area of the wheel with the road is a few square centimeters only. This load is transferred to lower layers of the road bottom. If mass concrete, this load is distributed at an angle of 1 on 1 and if not 2 on 1 down the road mass.
  - 1.5. Pressure is high at the place just below the wheel. So, the road material should be strong to stand this. As the pressure decreases with the depth, stronger materials are used at the top and less strong at lower levels.
2. Why different materials are used?
 

Different materials are used because stronger materials are costly and weaker materials are cheaper.

3. Why tests are done for approval and during construction?
  - 3.1. For approval of source of supply, we check in order to get the work is started with proper materials.
  - 3.2. During construction the materials are tested to see that all materials supplied to the project during the construction period at different times are within the required /specified standard.
  - 3.3. The other tests are done to ensure the work is done to the required standard. Common examples of acceptable workmanships are density tests done for earth compaction and cube test for concrete.
4. What are the criteria for road construction?
  - 4.1. A road is made to go from one place to another place or places
  - 4.2. In express ways the shortest path will be preferred but due to many other factors the path selected is not the shortest in the end
  - 4.3. The path of the road on ground is called the flat plan of the road and is defined by a centerline with straight and curved sections. These curves can be circular or parabolic curves. A curve is sharp when the angle of the path deviation is more [we call this the angle of deviation  $\Delta$ ] and the radius of the curve is small. For small curves parabolic curves can be adopted with a circular curve at the middle to form a smooth curve. If the curve radius can be more than 100 m then the curve is not sharp.
  - 4.4. The earth surface is not flat. Therefore, the road surface will climb up and go down at different places. This change of level with the length is called the longitudinal section or the profile of the road. This too has to be smooth. In normal ground the road slope along the length will be below 10% preferably; but in mountainous areas these are ignored. Vertical curves are made smooth by circular curves at the point of meeting two straight line sections in the profile drawing. The smoothness is formed by having a value called  $k > 5$  where  $k$  is the length in meters for change of slope by [1%] one percent.
  - 4.5. To drain out road water the road surface is sloped to either edge across the road. This cross slope is called the camber and is generally -2.5% for asphalt 3 to 3.5 percent for macadam or sealed surfaces [DBST or SBST and sand or chip seal surfaces]. At curves to ease the bend and to minimize vehicles being pushed out of the road at high speed the road is sloped inwards at the curve. This slope is called super elevation maximum super elevation is below 10%

- 4.6. The width of a road depends on the number of vehicles to travel and their size. Normally a lane width is 3 m. For a single lane road as two vehicles moving in both directions are required to pass each other hence, the width is 3 to 5.5 m. For a double-lane road the width is 6.2 minimum and will be 7.5 maximum. Extra width is provided when more vehicles pass frequently and higher speeds are used by the motorists. These widths given are for the carriageway, where vehicle only are supposed to travel. For the pedestrians the road shoulder is there. Paved road shoulders vary from 600 mm to 1.2m, and any road will have a soft shoulder of minimum width to provide lateral support for the pushing force of the earth fill, by the vehicle load and the self-weight of soil mass. All these come under road capacity.
- 4.7. In highly populated areas, pedestrian walks and cycle lanes are also provided for the safety of exposed persons. 4 or 6 lane roads are provided when traffic density, i. e. the vehicle passage frequency is very high.
- 4.8. For more details, please read RDA guide books for geometric design and pavement design of roads in Sri Lanka

## Chapter 2 – Construction Planning

### Why do we plan?

To avoid

- Omissions
- Delay
- Partial failure
- Total failure

Due to

- Magnitude
- Complexity
- Specialty of tasks

Two main stages of construction planning are,

1. Pre-tender planning
2. Post tender planning

Done by

- A. Pre-tender planning by the employer /engineer
- B. Pre-tender planning by the bidder
- C. Post tender planning by the employer /engineer
- D. Post tender planning by the bidder

- A. Pretender planning by the employer
  1. Job identification
  2. Finance
  3. Scope of the job
  4. Consultant(s) /Engineer selection
  5. Method of implementation
  6. Document preparation

**We shall discuss the common practice of engaging a contractor leaving out direct construction engaging own resources**

After serious thinking on first 3 of the 6 listed above, the employer will select the experts for advice to decide on method of implementation and handover document preparation to the selected advisors. To ease dealings, one person will be selected as Project Manager, who will coordinate and get the services of the other experts as needed. He himself may be an expert in one of the fields but mainly having, ability to plan.

#### Pre-tender planning by the Project Manager

##### Basic steps

1. Conduct preliminary meeting with the employer followed by meetings with other experts as required
2. Agree scope of the job with due consideration for finance available
3. Propose and agree with the employer the standards and quality of the finished job
4. Agree with the employer the level of documentation needed and the monitoring expected
5. Prepare preliminary design and specifications for the job as agreed with the employer
6. Prepare out line for documents and level of supervision
7. Fine tune the document with inputs from other experts as necessary
8. Based on the above prepare time schedule and resources required for actual monitoring and basic construction time schedule and a rough method of construction for works
9. When all required information and documents are ready advertise for bids

#### B. Pre- tender planning by the bidder

1. Before the tender notice
2. After the tender notice

##### 1. Before the tender notice

###### I. General considerations

1. Type of job
2. Geographical location(s)
3. Type of client
4. Magnitude of the job
5. Complexity of the job
6. Type of consultant/Engineer

**Based on these the bidder should decide to collect bid document or not**

## II. General information that should be available;

1. Current material prices
2. Current labor /subcontractor rates
3. Current hire rates for machine
4. Cost analysis or work norms for common work items
5. Labor laws
6. Other laws relevant to construction such as royalty, building regulations, condominium regulations, thorough fare ordinance for road construction

## III. Company details

1. Previous experience
2. Organization chart
3. Audited accounts
4. Company registration, National grading as a construction organization
5. Completion certificates and awards etc.
6. Bankers
7. A latest updated brochure if possible

## 2. After the tender notice

- a) Decision to collect or not
- b) Decision to bid or not [after studying the document]
- c) Collect all information available from the employer at the earliest possible time
- d) Study and obtain all necessary clarification from the bid advertiser/employer
- e) Attend the pre-tender meeting and site visit
- f) Decide on a tender preparation team, capable, responsible and of high integrity
- g) Hold at least two meetings with the tender preparation team after they have studied the document (i) to find out what more is required to price the bid and decide on the time schedule for finalizing the bid (ii) to find what more is to be acquired by the company if the tender is won
- h) Plan for winning
  - i. List the requirements against what the company has
  - ii. Find ways of filling gaps – before close of the tender. If possible, give assurance on hiring agreements, bio data of persons willing to join
  - iii. Study the competitors
    - Who have collected the bid documents
    - Quantum of work in their hand; total and in specific field
    - Likely low bidders; their general pattern of bidding and their current work in hand situation

- Listen to competitor views at the pre-tender meetings and at site visit
- Compare present situation of your company with the competitors
- iv. Completeness – Check and double check the completeness of your submission
- v. Responsiveness
  - Ensure your bid submission is responsive in every respect
  - Avoid common errors: Seal and signature; power of attorney is properly registered; Formats are followed 100% correct; Arithmetical errors [silliest of all] are nonexistent; Sensible brief and attractive method statements [seldom found in local tenders]
  - Relevant information on; equipment, material sources, labor schedules, superintending team
- vi. Costing
  - Based on site visit information regarding, terrain, weather, availability of engineering soils, borrow areas, ground water, disposal yards, stores/stockpile yards, housing for staff; cost of materials, labor and availability in the project locality; Data on costing of preliminaries in BOQ and anything missing.
  - Method of construction will be decisive on your cost of some items. Such decisions should be discussed at the meeting of the tender preparation team and should be priced accordingly. If the method has a major effect on cost; it should be specifically mentioned even if a method statement is not required in instructions to bidders
  - Alternate designs to save cost are good for winning tenders [provided the employer does not object to it]; generally private sector clients like, and state sector officers reject these. This works well for reputed major contractors.
- vii. Item costs
  - Based on available data item costs should be prepared as basic costs for at least 50% of the items covering, items of high BOQ quantity. This will cover 70% of the total value
  - Quantities given in BOQ should be randomly checked and accuracy should be assessed as dependable or not.
  - If not dependable, major items and items likely to increase in quantity should be assessed and ensure that the basic cost is a safe value to perform. NEVER REDUCE THEM TO WIN. Avoid being the winner at the tender and looser at the end of the project



- Items of which the BOQ quantity is likely to be less shall be priced at basic cost plus a lower markup than others
- viii. Mark up
  - Depends on the company; general overhead, pricing policy, work in hand, ease of receiving payments from the employer, cooperation/cordiality in operation time with the employer/Engineer, Extra expenditure required by nature of work, locality, client, Engineer's representative, local politician, or may be the office helper, how bad is the need to win
  - Need not be a constant percentage for all items
  - Competitors' likely markup has to be guessed

[Bid preparation data files should be preserved till the award and beyond if won, as rate break ups etc. are requested by the Engineer for the contract]

#### Planning after award

1. Requirements of the Employer/Engineer
2. Requirements of the contractor/company
3. Requirements for construction

#### 1. Requirements of the Employer /Engineer:

- Performance and guarantee bonds
- Program/method statements
- Quality assurance Plan [if a QA contract]
- Engineer's and contractor's facilities listed in the contract

#### 2. Requirements of the contractor /company

- All requirements for mobilization and to commence work other than those listed in the contract.
- Systems - Material control; Equipment control; Cost control; Human resource control

#### 3. Requirements for construction

As for any other thing, construction too need short term, medium term and long-term planning unless the construction contract itself is short term.

Long term plan need not be detailed and being sketchy is sufficient. Yet the decision should be firm, otherwise the plan will be entirely changed after some time and a haphazard plan will be implemented. Medium term plan is more detailed after knowing

site conditions well. Short term plan covers every little detail required for undisturbed action.

Long term plan will be decided at the higher levels may be the company head office with the construction manager involved. Medium term plan should be entirely the construction manager's purview - may be with planner/assistants. Short term plan is by the lower staff directly at work with the guidance / consent of the construction manager. Long term plan covers time, resources and finances for the whole works. The main activities are considered [generally 25 to 30 Nos.]

Medium term plan covers selected activities in detail. Some of the major activities will be subdivided and with resource and finance allocation. Attention will be on activities at hand to be detailed. The period of consideration will be one month or 3 months depending on the project period.

Short term plan is the daily work plan and even shorter considering the changes on the day such as labor shortage or break-down of machine, rain etc. sometimes called 'on the job' plan, getting ready for the coming situation. The attention is to avoid omissions and failures. An experienced foreman will be very helpful.

### **Long term planning**

Long term planning is very common and engineers and managers deal with them often as activity time schedules [commonly called the program] and sometimes with resource schedules.

Program – gives activity time relationship and without resources it is of no meaning

Activity / time /location, chart – also used as when activities are distributed in space as in the case of pipe lines, roads and canal construction projects.

Resources schedules – Tables showing resources quantities for activities at a given period of time [week / month] through the construction period. Sometimes, the resource quantities are tabulated as for the whole project without showing activity wise. This is not very useful as some activities may suffer depending on the site work distribution.

For convenience resources schedules are separately prepared for materials, labor and machinery.

Finance schedule – shown as a cumulative cost vs. time graph and is termed cash flow diagram.

In this graph income and expenditure are shown on the same axes to notice easily the gap in financing.

**Those given above are documentary presentations of the long-term planning out put**

How do we prepare these documents?

- Identify the activities required to complete the construction
- Identify what is required initially to commence actual physical construction
- Decide the actions which can be grouped together, based on similarity in materials used, skills and machinery required or the closeness in sequence of construction. One such group is called an activity.
- Suggest / assess /select what method is used to carry out each such activity on broad basis.
- Decide independently for each activity the resources requirement and time to complete
- Select logical sequence of activities to commence due to,
  - The nature of construction
  - The method selected
  - Identify the possible overlap of activities or the need to be far apart [necessary time gap or lag between activities.]
- Identify sharing of re-usable resources
- Identify lead time in obtaining resources not available in-house. Adjust resource schedule accordingly
- Identify idling resources at times assuming every resource listed will not be sent out until the project is over
- Improve the plan to minimize idling by modifying the methods, sequences of activities, outsourcing peak requirements, possibility of release and recall when in need of items such as hired machinery.
- **The four dot points just above is called resource balancing**

Ways of presenting activity time schedule

1. Bar chart or bar diagram
2. Linked bar chart
3. Critical path method [CPM] network
4. Precedence diagram

[2 and 4 can be prepared easily using MS project software.]

Annex gives a simple example. Bar chart being so simple, is not explained here.

## SOME DEFINITIONS

- **Action** – a Thing done
- **Activity** - A series of actions to complete a task
- **Activity slack** – Difference between earliest and latest finish time of an activity; same as total float
- **Bar chart / Gantt chart** – A schedule of activities showing their durations in the form of bars or lines plotted to scale on a time scale.
- **Critical path** – The longest sequence of activities between the beginning and the end of a project. This determines the minimum completion time period of a project.
- **Critical activity** – An activity falling in the sequence of the critical path. There is no float for such an activity.
- **CPM** –Critical Path Method
- **Dummy activity** – An activity used to show sequence of operation in an activity network. This is represented by broken line arrow. This does not mean any physical activity and has no duration.
- **Event** – Point of time represented by start or end of one or more activities in a CPM network
- **Event slack** – Difference between the latest event time and the earliest event time
- **Float** – The period of time by which an activity not in the critical path can be delayed or its duration can be extended without affecting next activities.
- **Free float** – The time available between earliest finish of an activity and the earliest start of the following activity.
- **Interfering float** – Overlap of time between the latest finish and the earliest start of the next activity
- **PERT** – Program Evaluation and Review Technique; Similar to CPM but having 03-time assessment for activities i. e. optimistic, pessimistic and most likely.
- **Precedence diagram**- A job on the node diagram of network analysis introduced in 1960s. Activities are identified by boxes and the relationships are shown by arrows.
- **Slack** – A term used in PERT. The spare time available before key event has to be completed.
- **Total float**- Time available between the earliest and latest finish

## CPM network

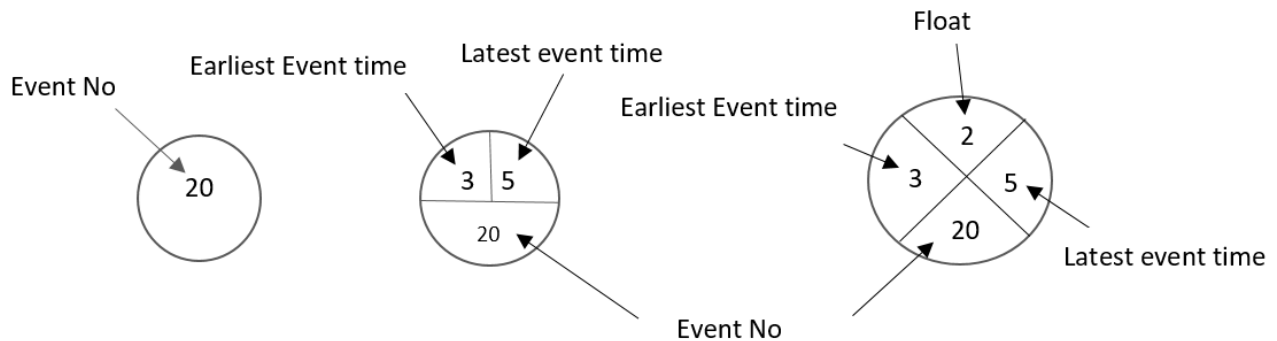
Identified activities are denoted by arrows between two nodes.

Events are denoted by nodes [circles] indicating start and end of an activity

Event is identified by a number; the activity is identified by the two numbers and the two ends of the arrow, showing the activity.

Sometimes the node circle is divided into 3 or 4 sectors. Bottom sector carries the event number. Left and right sectors carry earliest start and latest event times. If divided to 4 sectors the top one gives the float.

Sample nodes are given below



More than one activity can start or end at a node.

Events show logical sequence of activities. If it is difficult to show the sequence diagrammatically, a dummy activity is introduced.

A dummy activity is only in the diagram and actually no physical work is meant. The dummy is presented by an arrow shown in a broken line. It has no activity name or an activity time period.

Name of the activity is written above the arrow line and the time duration of the activity is given below the arrow line.

The arrow path with the highest summation of the duration times is called the CRITICAL PATH.

The difference of sum of durations along a path and that of another is called the float of the lesser path. Similarly float of an activity is found by the difference of earliest and least event times [marked in the node]

**There is no float for the activities in the critical path.**

### **Precedence diagram**

An activity is shown by box / cage.

Sequence is shown by an arrow. Arrow is drawn from the right face of the box to the left face of the box showing the activity to follow.

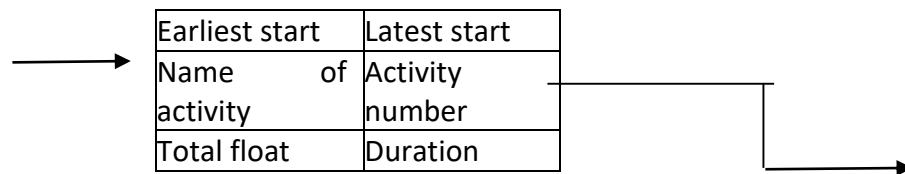
Generally arrows are drawn in horizontal and vertical directions and not at angles as a practice.

Activity box carries information of earliest start, latest finish, activity name, activity number, total float, and duration.

A sample activity box is given below

Earliest finish

Latest finish



### **Activity /location//time chart**

Time and location are given in two axes.

Time is generally along the horizontal axis.

Activity is drawn as line. If the activity is started in two different locations at the same time two lines indicate that activity.

If a line is parallel to the time axis it denotes that the activity is done at one place.

This is helpful in setting work gangs or machinery distribution at different locations in project that is spread out in space.

### Cash flow chart—[S curve]

Two axes show cost in vertical and time in horizontal axis.

Cumulative value of income or expenditure is shown in the vertical axis.

The shape of the graph is a near 'S' due to probable pattern of expenditure as low at the beginning and high at the middle and at the end as work naturally grow slow while getting ready and at the end in finishing leftovers etc.

But this can be different e. g. when retention money is released at the end.

A shape can be established with 3 straight lines by considering 5% progress at the first and last 10 to 15 per cent of time period and the rest to be a straight line, connecting the two points. This can be for initial planning.

When both income and expenditure are plotted in the same diagram, whether the project is self-financing or needs cash input from outside can be seen.

### How do we decide values for activity, resources, and finance/ time schedules?

Quantities in BOQ are useful as a starting point. But all BOQ items are not separate activities. BOQ quantities are always not accurate. These need be checked at least for major and costly activities.

Quantities should be revised when more and more information is available with time.

Resource requirements can be calculated when work quantities are known using work norms.

Commonly used work norms are HSR, BSR, Hand books, Machinery production manual, company records of previous project analyses.

Some of the work norms in BSR are not valid due to present day practices and use of small machinery and less labour, e. g. quantities of rubble and bricks and labor in masonry works. Planner should be careful in selecting norms from different sources.

Labor and machinery output depend on working conditions and the methods selected. Due corrections are to be made on these.

Activity durations for some items also can be calculated from work norms.

Activity costs can be assessed using past records of the company using current rates. If not relevant pay item costs less profit and overheads can be taken as the cost. But this has to be corrected with actual expenditure.

Income can be easily worked out from pay items of the BOQ and the expected work output during the relevant period.

## Attachment 1

A time schedule example:

### MAKING A CUP OF TEA

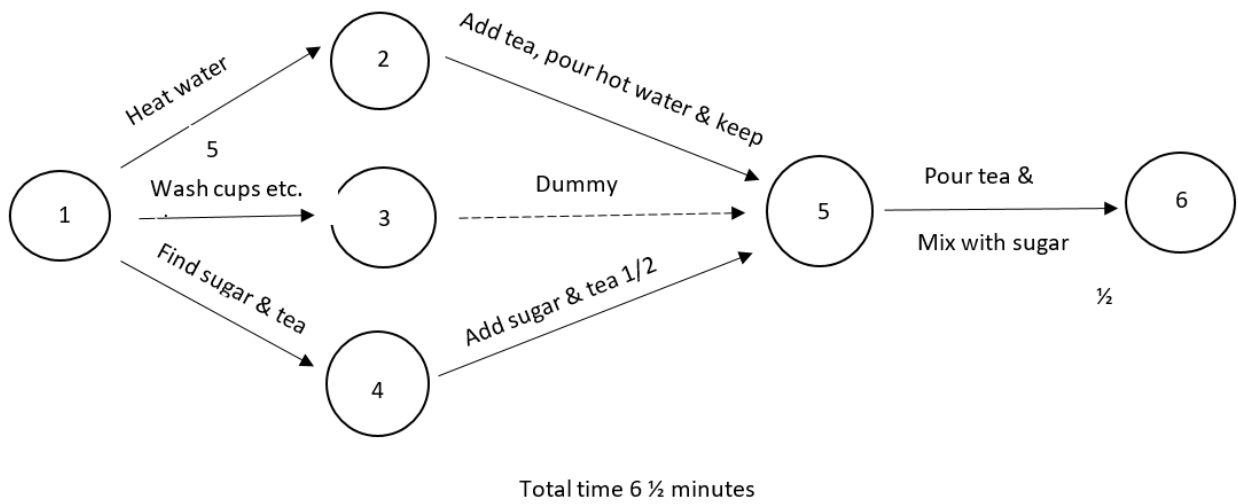
Activity	Duration	Earliest start	latest start
1. Heat water	5	1	3
2. Wash cups spoon and strainer	1	1	2
3. Find sugar and tea	1	1	1
4. Pour hot water and tea and keep	1	1	1
5. Add sugar to cup	$\frac{1}{2}$	$\frac{1}{2}$	1
6. Pour tea to cup and mix with sugar	$\frac{1}{2}$	0	1
Sum of durations	9		

### Linked bar chart

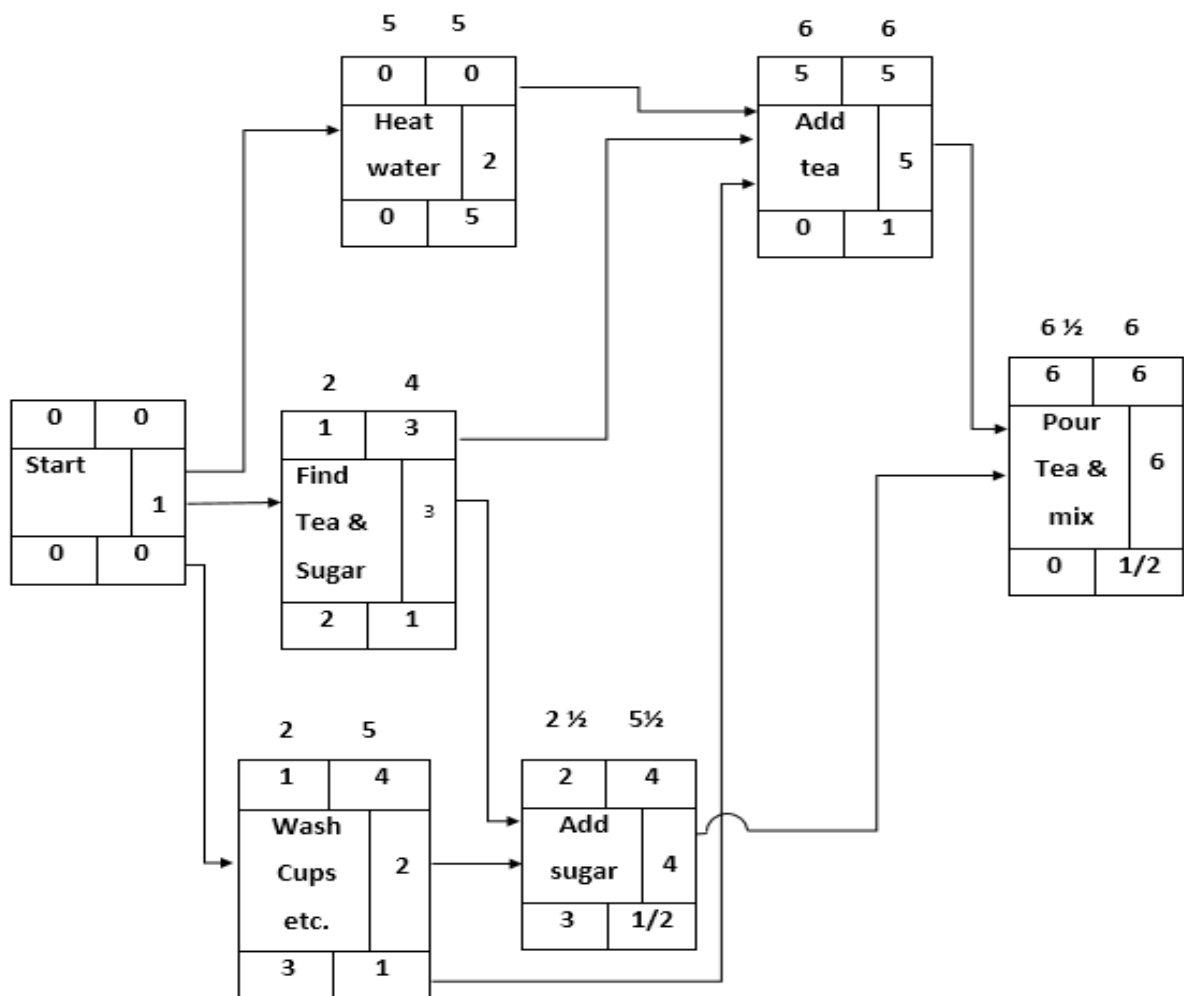
Number	Activity	1	2	3	4	5	6	7	8
1	Heat water								
2	Wash cups spoon and strainer								
3	Find sugar & tea								
4	Pour hot water & tea and keep								
5	Add sugar to cup								
6	Pour tea to cup & mix with sugar								



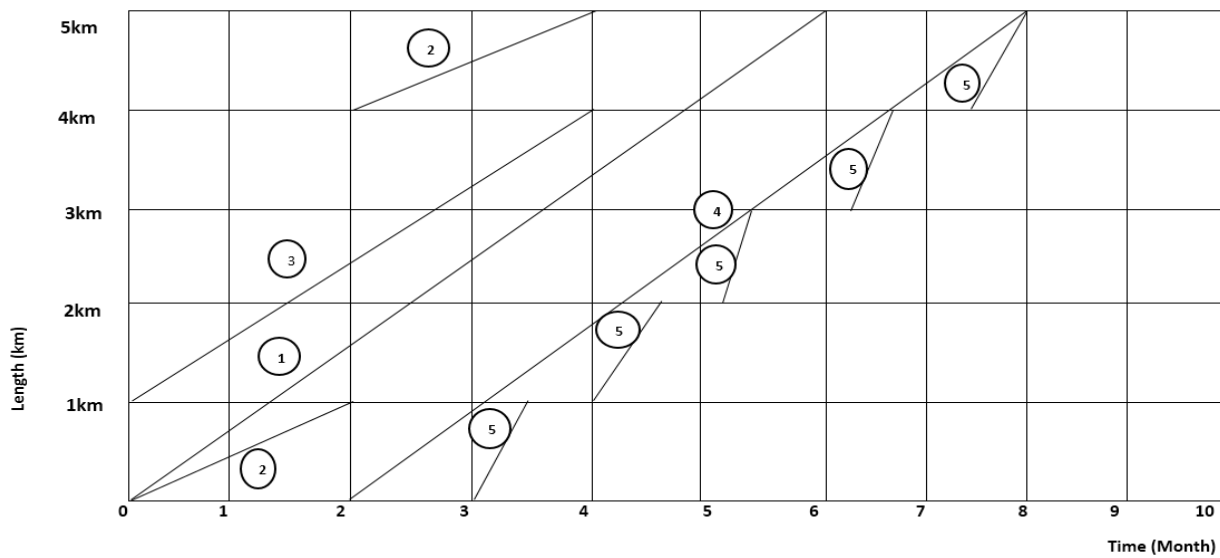
## CPM network



Precedence diagram for making a cup of tea

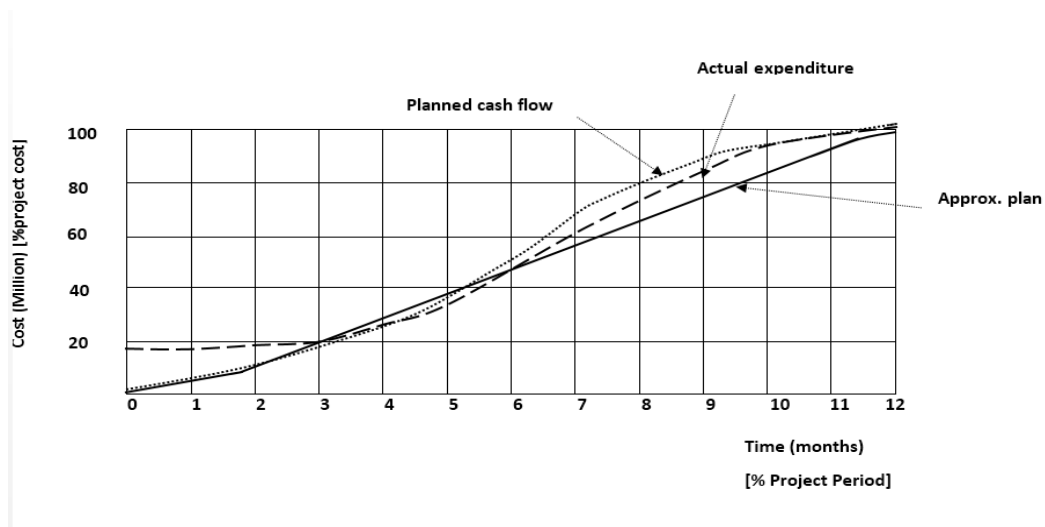


Activity / location / time chart --Road construction example. [See for activities below]



Identified activities list

1. Clearing and grubbing
2. Embankment filling
3. Road pavement excavation
4. Base course
5. Prime coat [assumed 1 km in 2 weeks]



Cash flow diagram [S-curve]

### **Chapter 3 - How to be organized for clearing the hurdles in a construction contract**

**Main Objectives:** Be within cost and time

**Secondary objectives:** Quality and personal relationships

**Tertiary objectives:** Satisfaction of all in the team to the best possible extent

A. Hurdles to be overcome can be categorized broadly under 3 headings

1. Internal – having required means – 05 “M” s, i. e. Men, Materials, Machinery, Methods and Money; and effect of poor bidding
2. External – Employer; Engineer; Service organizations; legal requirements & hence the authorities; weather; force majeure; public, NGO/CBO, local politicians’ requests and complaints
3. Contractual – Requirements in contract conditions and specifications [special provisions]; Ambiguities and omissions in them; BOQ errors [quantity over run, extra works and unused items]

B. Internal hurdles

1. Materials arrangement and methods are main responsibilities of the Site Manager/Contractor’s representative at site
2. For other ‘M’s and poor bidding the organization has more responsibility than the person at site.

Men [includes suitable capable women too] - capable, reliable, loyal people should be hand picked

Materials – Shall be as per specifications – NOT marginally acceptable; More than 01 source to be approved from the beginning; Effective storage;

Machinery – Right capacity, Right numbers, and in good working order has to be observed [if not reliable extra for stand-by should be available or a good mechanical support should be arranged for efficient minor repairs]

Methods - shall meet-

- \* specification requirements;
- \* site conditions;
- \* time constraints;
- \* skill of people and available materials against the actual need;
- \* available machinery against the ideally required machinery

- Have a general overall method statement written
- Prepare detailed method statements for COMPLEX, and SPECIALIZED work items
- Method statement is what you plan to do to achieve the construction requirement, considering the time, weather, terrain, design, your resource limitations
- Alternate design or modifications may be requested for approval from the Engineer

Money - Required portion of mobilization advance should be available for the site

- IPA should be submitted from 2nd month
- Cash requirement should be obtained at the beginning of the month
- Cash 'imprest' should be maintained by submitting the statement of use before the half mark [depends on your company]
- Avoid payment delays by
  - \*timely submission of IPA-- proper and steady joint measurements;
  - \*recommendation- Avoid delays caused by incomplete submission and lethargic Engineer's representatives
  - \*Payment – Employer's lethargy; - Remedy is to claim interest after negotiation for speedy settlement [if you claim interest, no payment will be made when minimum IPC value is not reached by ONE cent]

#### NOTES:

1. 30% of contract sum is enough for a construction site to be run well without cash flow problems even when mobilization advance is fully recovered, provided that IPA are paid in 56 days and no new equipment has to be purchased for the project using Mobilization Advance.
2. CR should submit a complete IPA with all supporting documents
3. New rates should be agreed when variation / extra works are ordered before commencing work, whenever possible.
4. No conditions of contract give formats for IPA and Claim submission; this is to be decided by the Engineer; Some Engineers do not bother about these until the need comes or even after; they inform time and again to change as they wish. Sometimes the culprit is the Employer; whatever it is, these contribute to delay in payments; The BEST APPROACH will be for CR to submit his formats and presentation at the beginning of the project and press for reply.

5. Clarify with the Engineer, payments for concrete with 7day tests. As IPA is interim, if test fails payment can be deducted from the next IPA. Otherwise, cash lockup is too big as concrete is a high- cost item

POOR BIDDING: low rates just meeting the cost or not meeting it; exorbitant rates for avoidable items which when felt, the Employer requests the Engineer to omit or minimize.

### **CR is helpless here**

The only thing CR can do is to

- a) Study the document at the beginning
- b) Re –calculate item quantities which can be easily checked
- c) Read specifications thoroughly and be sure of what one has to cover to get the payment and claim for extra works for others. Be sure here to read the pricing preamble. If pay items are not in BOQ you have to do the work correctly even if not paid.
- d) Point out the unrealistic items and the cost effect to the Company Head Office

### **C. External hurdles**

1. The Employer – The Employer’s requirements provided in contract AND ANY OTHER!!!![Sri Lankan condition we all know but do not talk openly]
  - PAYMENT DELAYS AFTER THE ENGINEER’S CERTIFICATION
  - Local currency component delays [only remedy is to claim on cost of finance under sub clause 14.8]
  - Agreeing on EOT, rates for variation and extra works
  - Approval of key staff and subcontractors [in some contracts only]
  - Agreeing on selection of DB
2. The Engineer
  - Engineer’s facilities
  - Drawing approvals
  - Formats for progress reports and IPA etc.
  - QA, safety and environment monitoring action plans
  - joint measurements
  - Signature for RFI & test reports
3. Utility and other organizations - For road projects,
  - Electricity
  - Water NWS&DB and community

- Telecommunication
- Irrigation/ agrarian
- Some times Pradeshia Sabha

#### 4. Legal authorities

- Tree cutting – Grama Niladari, Divisional secretary, Forest Department, Government Agent /District Secretary timber corporation to hand over
- Borrows – Grama Niladari, Divisional secretary, Forest Department, GSMB
- Rock excavation – GSMB, Explosives controller, Police and indirectly, Divisional Secretary, Archeology Department, CEA
- Dump yards – Grama Niladari, Divisional Secretary, local authority
- **Any damn thing of any development project - CEA**

#### 5. The public [those having “fever” only] NGOs, CBOs, Local authority, Local Politicos, and any other stake holders

- Depends on how important they think they are and how active they are
- If land acquisition or land donation is involved the Employer has to be involved

#### D. Contractual hurdles

##### 1. Bonds & insurances

- If a format is given follow it. Do not just submit what the bank gives
- Read particular contract conditions and specifications and do exactly the needed
- Validity period - if given follow it
- If not, project period or 01year - to be extended as required, before expiry

##### 2. Construction program-

- Construction program is not a bar schedule or a PERT chart
- The bar chart shows only activity durations and their sequence and inter relationship only
- **Unless resource –time schedules** and method of construction [a broad outline; – details can be given separately for complex/special activities when those are to be started. State this in your first method of construction submission] **are given, the construction program is incomplete and cannot be reviewed by the Engineer.**

- If not accepted/ commented by the Engineer within 21 days of receipt, the program is considered accepted [under FIDIC]

### 3. Key staff

- Should be qualified and capable, responsible, loyal
- Depending on the requirements in the document the Engineer or the Employer will approve the key staff. This approval should be requested before posting persons
- Select people with required qualifications and experience for key staff, if not approval is difficult. Capability does not work here.
- Capable and responsible persons are required to perform. Number of heads will not help.
- Number of each category should be as stated in the document or more
- Staff reduction is possible with progress not TIME

### 4. Laboratory

- Shall be as specified; any reduction may be discussed and agreed

### 5. Site establishment of the Contractor

- Shall be as specified or more in numbers and categories

### 6. Borrows, dump and stock pile yards

- As specified; approval is a must
- If not, too many letters and headaches
- Adequacy and quality of material in borrows have to be studied before establishing the borrows, by bore hole tests and grid survey to quantify
- Protection required should be studied and provided in case of dumps and stock pile yards
- Do not delay these till construction commences

### 7. Surveying and leveling

- Establish control points & TBM [linked to national grid or not as specified]
- Take levels



- Involve the Engineer's representatives in the process by giving RFI, / in daily programs
- Officially submit records [level sheets, tie measurements, values of TBM and control points] to the Engineer-----
- EGL at the start
- Finished levels, with as built drawings

#### 8. Drawing submission

- If the Engineer does not give a format submit your drawing format sample for approval
- By giving a complete format, do not leave room for the Engineer to change format every now and then, because you have to submit hundreds of drawing sheets
- Corrections of drawings should be complete, do not leave it in the hands of junior officers
- PM should glance through before signing

#### 9. Progress reports, IPA, test reports, RFI and NCR

- Submit your formats for the Engineer to approve because some engineers are slow for these and wants changes when anything is submitted
- If the Engineer issues at the beginning, follow it
- If shortcomings are felt, discuss than banging a letter back

#### 10. Joint measurements

- Ensure that joint measurements are taken weekly
- Ensure that the sheet you attach In IPA are signed by both parties, records in private note books cannot be taken as completing joint measurements weekly
- If the Engineer' representative is delaying, include joint measurements [giving locations] in the daily program

#### 11. RFI

- Select hold point items correctly in your QA plan, Submit RFI for those only
- Others can be given in daily program with location and approximate time of start
- Submit realistic, accurate daily program with location and time for each work it may go to 2 or 3 pages

- Be sure that you start any work item within 01 hour of expected starting time given; any delay can be informed over the phone
- Do not make the supervising officer/inspector to travel unnecessarily because of your poor planning; he has a right to report against you
- If the inspector is repeatedly late, inform his superior; do not go to RE for every little thing; you will have PR problems with others; BUT do not tolerate too long for one individual
- Do not do any work without marking in daily program or without RFI, any addition may be requested and added on before starting; correct all copies

## 12. Quality of work

- Follow specification as much as practically possible not conveniently possible
- Do not try to relax specifications
- Protection, barricading and night lighting are important. The Engineer can cut your payments
- Curing is very important. If not done, the Engineer can ask to demolish. You cannot prove goodness by strength tests, as tests do not guarantee the life time of concrete
- Quality specified, cannot be compromised for speed or cost

## 13. Variations / extra works

- Do not commence any variation or extra work without written instruction or a confirmation of verbal instruction or a record in a minutes of meeting
- Formal issuing of variation may be delayed and it is unavoidable
- Rate should be offered as soon as possible by the contractor to avoid delay in issuing of formal V.O.
- Do not submit new analysis when rates can be selected or derived from available rates in BOQ [sub clause 12.3 FIDIC]
- The contractor can negotiate rates with the Employer [with the Engineer is not final]
- Engineer has authority to determine
- Contractor has advantage, only if no similar work is in BOQ to derive a rate, when a totally new item is introduced
- If disagreed with the Engineer's determination, referring to DB is the next step

#### 14. Provisional sum items

- Provisional sums are money provisions given for the Employer to use for likely items- but extent unknown
- Contractor has no authority to use them without prior consent of the Employer and as instructed by the Engineer
- If done without instruction payment can be refused.
- The cost for a provisional item need not be within the allowed sum; it may exceed by 100% even
- The Engineer should be wise enough to get contractor's cost proposal or market values to instruct
- The Engineer should get the Employer's concurrence; if the allowed sum exceeds by a big margin, he will be seen as an irresponsible person in his capacity as the Engineer for a contract

#### 15. Force majeure'

- Things beyond the control of the contractor, the Employer or the Engineer
- These are called acts of God and rare occurrences as given in the clause 19
- Sub clause 19.1 gives definitions
- Sub clause 19.2 – Notice of force Majeure' which shall be given within 14 days of being aware, specifying the obligations, performance which will be prevented
- "Notwithstanding any other provisions of this clause, Force majeure' shall not apply to obligations of either party to make payments to the other party under the contract"
- Sub clause 19.4 consequences of Force majeure' – EOT; cost of works or goods damaged destructed to the extent that they are not indemnified by insurance

#### 16. Claims

- Claim submission should be meaningful
- There should be an event for a claim
- The Claim should be an entitlement under any of the contract clauses
- Notice for claim should be given within 28 days of being aware of the event
- The notice should be complete to include (a) The event and time (b) referring to sub clause 20.1 [notice] and any other clause(s) entitling the contractor for the claim
- If not, the Engineer can inform it as an improper notice and disregard it.

[There are more descriptions in chapter 4 under section 6.0 construction claims, site records and dispute resolution and a separate chapter [09] for claims but not the details of fighting a claim]

## 17. Dispute Board

- Be sure to appoint the DB within the stipulated time
- If too late it will be an 'ad-hoc DB'
- Many capable members in recognized panels do not accept this
- If accepted they do not agree for standard clauses given in FIDIC for DB
- Cost saving on DB's retainer fee is the thinking of many employers; when disputes occur, it will be felt because if it is in the construction contract conditions, you have to go to DB first before arbitration. Then it is a waste of time and money.
- My advice is DO NOT AGREE for the employer proposed DB member if he is not in the panels of IESL, ICTAD or ICLP as he is a favoured person and will not be impartial. Now there is a trend to help friends, so the friend will also help in return
- When agreement on DB member is not possible refer to an institution for nomination even if one is not mentioned in the contract
- If appointed in time make use of DB's knowledge and experience
  - a) As opinion – which he has to give but may not be reasoned out in detail and the opinion is not binding
  - b) As decision- DB has to reason out his decision and it is binding unless the disagreed party informs the other party the Engineer and the DB giving reasons within 28 days of receiving the decision
- The disadvantage of DB is, there is no law to implement DB decision in Sri Lanka. If DB decision is not agreed or obliged the next step is a last try for negotiation between the parties and failing to commence arbitration
- DB decision can be submitted as evidence for arbitration. But the arbitrator may or may not consider it. Arbitrator cannot refuse submission without studying it. So, the DB referral may help in some way but there is no guarantee of a solution, if the parties do not accept the DB decision

## Chapter 4 - How to administer / manage contracts

### A. Pre-requisites and purpose

#### 1. What a contract is and actions needed

1.1 An agreement is said to be the understanding of like minds for a purpose(s) [may be for a limited period]. So, it has to be,

- Voluntary and not under compulsion by persons or circumstances as far as possible
- In good faith
- For practically achievable things
- Not violating legal and social norms

If these are not within the background of the agreement reached, more chances are there for the agreement to be not honored by one or both parties

1.2 The parties to a contract shall,

- Show due respect to the other party
- Each party has to follow ethics of his profession [trade]
- A registered contractor or a state officer is a professional to some degree [may not be a full professional whose ethical rules are stipulated by a governing body] for his education and experience
- Be polite, understanding, open and clear of the purpose/aim of the contract agreement
- The relationship has to be formal; need not be one of friendliness or animosity
- Be READY FOR OFFICAL BUT INFORMAL DISCUSSIONS, FOR BETTER UNDERSTANDING **but within limits of integrity**

1.3 The aim of the Employer is to.

- Get the required work completed the way it will serve the purpose of the operation/use expected [to an acceptable level; never below par]
- Obtain the service or the product available for use in expected time [within a fair delay period as he thinks]
- Be within agreed cost [with reasonable changes due to circumstances and events]

1.4 The aim of the contractor is to,

- Get the expected profit or more [within limits of uncertainties] during a period agreed to complete the works / service

- Effectively use his available resources among his works in hand [not concentrating on one project at the expense of others]
- Keep his cash flow as much positive as possible all times during the contract period
- Avoid being blacklisted, terminated or disgraced
- Have favorable working conditions
- Build his image or not to tarnish the image already built [as he thinks]

#### 1.5 The common aim should ideally be

- The completed product or service should be good and not at all bad or below par
- The contractor should **never lose** his invested money [Loss of expected profit is a possibility in business; profit over the expected value too is possible]
- The final product should be available for use in time at the agreed date [or even after]
- Unplanned extra cost should not have to be borne by the Employer making him uncomfortable to bear
- Dispute resolution situations should not arise. Many a disagreement can be resolved out amicably with mutual understanding, if the parties are ready to compromise [within limits of integrity]
- Even after dispute resolution, parties should be able to work in the same or next contract without reservations/restrictions or suspicion [Worst is, not being able to look at each other's face at an outside place]

#### 1.6 The Employer's requirements are stated in

- Bid documents
- Contract agreement
- Contract conditions – General & Particular or special
- Specifications – standard & special or particular [some documents call this Technical but it is wrong usage]
- Drawings
- BOQ
- Letter of acceptance and other pre-tender and post tender correspondence

#### 1.7 The contractor's requirements are not generally stated But,

- Expected financial gain can be seen from the rates [in comparison with others]
- Sequence of operations is seen from the preliminary program itself

- Resources planned to be used, is seen from resource schedules submitted with the program
- Method of construction and the staff is given in the method statement that has to be submitted after the letter of acceptance
- Intended monthly expenditure / interim payment value can be seen from the cash flow diagram

1.8 Requirements not stated in the above will be in correspondence made during construction time.

1.9 Such Correspondence from either party has to be,

- Clear and to the point
- Should have a heading
  - a) the contract number and the name
  - b) the particular subject addressed in the letter
- If two matters are written in the same letter the subject heading should have two components. If so, they should be given in totally separate sections or paragraphs with sub headings within the letter
- No two matters shall be explained in a mix
- If one matter is related to the other those should be dealt in separate sections but may be referred to previous sections or sentences
- Unrelated matters should be written in separate letters. This will help in providing copies for future reference
- Relevant sub clause of specifications and contract conditions should be referenced as appropriate
- In routine correspondence such formalities may not be observed. But if dispute situation is suspected to arise, extra care should be taken to refer to contract clauses & follow the deadlines given in the contract or specifications
- The sentences may be short and precise; paragraphs need not be too long; more than one paragraph is possible under one sub heading
- Required details should be presented but not too long as the focus will be lost
- Purpose of writing is to communicate views to the other party and hence should carry required detail in summary form and reference to past correspondence

## **B. Roles of the parties involved**

### **2. Obligation/authority / responsibility**

2.1 Obligation and authority go with responsibility. In general, as a practice the **contractor's** responsibilities are given as **obligations**, the **Engineer's** responsibilities are given as **authority** and the **Employer** has **responsibilities** and risk too is given in the contract.

Duties arise from the responsibilities given to the persons/officers in the relevant organization. The Engineer when named as the Engineer for the contract gets authority and responsibilities stated in the contract document and /or specifications; similarly, is for the contractor, when he signs the contract agreement or fulfills the obligations required in the letter of acceptance.

The contractor's representative when named gets his responsibilities. However, the contractor may delegate responsibilities fully or partly. If such delegation is restricting the performance of the representative, Employer and Engineer may question the contractor.

The level of delegation of authority and responsibility in preparing duty lists is internal administration and for achieving project goals.

**Each party has to give the organization chart and the list of duties of officers who deal with them to the other party as relevant, to avoid:**

- Misunderstanding
- Persons acting beyond the authority delegated
- Situations of overlap causing confusions or gaps causing "nobody's business"

2.2 **The obligations authorities and responsibilities are given in the contract conditions.**

**Specifications refer to works and all these are contractor's responsibilities. But checking and approval become Engineer's responsibility, if so stated, in the specifications.** Some times more things are added to the Engineer's responsibility from contract conditions than mentioned in the specifications when requirements in sections of both the documents are combined.

In this chapter those stated in contract conditions are listed in a table **but not the ones in specifications.**

Note should be made that, the clause when read may appear as Engineer's duty but contractor's contribution too is needed or sometimes the consent of the Employer. So, there is a column showing all who will be involved to finish the need as per the clause. ICTAD Conditions of contract SBD 01 and 03 are only given in the illustration below.



SDB 01			SDB 03		
Clause Nos.	Title	Parties involved	Sub Cl. Nos.	Title	Parties involved
<i>C = Contractor;</i>		<i>En = Engineer;</i>		<i>Em = employer</i>	
6	Communication	C, En, Em	2.1	Execution of contract	Em, C
7	Subcontracting	C, En	2.2	Provision of site	Em, C
8	Other contractors	C, En, Em	2.3	Engineer's instructions	En, C
9	Personnel	C, En,	2.4	Approvals	En, C
11	Employer's risks	Em, C, En,	3.1	Engineer's decision	En, C, Em
12	contractor's risks	C, En, Em	4.1	General obligations	C
13	Insurance	C, En, Em	4.2	Contractor's representative	C, Em En
14	Site investigation report	C, Em	4.3	Sub contractor's work	C, En, Em
15	Queries about the work	C, En,	4.4	Performance security	C,Em
16	Contractor to construct	C,	5.1	Employer's liabilities and risks	Em, C
17	Works to be completed by the intended date	C, En,	6.1	Execution of works	C, En
18	Approval by the Engineer	En,C	6.2	Program	C, En
19	Safety	C, En,	6.3	Extension of time	C, En, Em
20	Discoveries	C, En, Em	6.4	Late completion	C, En, Em
22	Access to site	Em, C	7.1	Completion	C, En
23	Instructions	En,C	7.2	Taking over	En,C,Em
24	Dispute resolutions	C, Em	8.1	Remedying of defects	C, En
25	Procedure for adjudication	C, Em	8.2	Uncovering & testing	C, En
26	Arbitration	C, Em	9.1	Right to vary	En,C
27	Program	C, En, Em	9.2	Valuation of variation	En
28	Extension of intended completion date	C, En, Em	9.3	Early warning	En, C, Em
29	Acceleration	C, En, Em	9.4	Right to claim	C, En, Em
30	Delays ordered by the engineer	En, C, Em	9.5	Variation and claim procedure	C, En
31	Management meetings	En, C, Em	10.1	Monthly statement	C, En, Em
32	Early warnings	C, En,	10.2	Valuation of works	C, En
33	Identifying defects	C, En,	10.3	Interim payment	C, En, Em
34	Tests	C, En, Em	10.4	Payment of first half retention	C, En, Em
35	Correction of defects	C, En, Em	10.5	Payment of second half retention	C, En, Em
36	Uncorrected defects	En, C, Em	10.6	Final payment	En, C, Em
37	Bills of quantities	C, En, Em	10.8	Delayed payments	En, C, Em
38	Change in bills of quantities	C, En, Em	10.9	Price adjustment	En, C, Em
39	Variations	C, En, Em	10.10	Subsequent legislation	En, C, Em

40	Payment for variations	C, En, Em	10.11	Advance payment	C, Em
41	Cash flow forecasts	En, C, Em	11.1	Default by contractor	En. C, Em
42	Payment certificates	C, En,	11.2	Default by employer	En. C, Em
44	Compensation events	C, En, Em	11.3	Insolvency	En. C
45	Change in law	C, En, Em	11.4	Payment upon termination	En. C, Em
48	Retention	C, En, Em	12.1	Contractor's care of the works	C, En.
50	Bonuses	C, En, Em	12.2	Force majeure'	En. C, Em
51	Advance payments	C, En, Em	13.1	Extent of cover	En. C, Em
52	Securities	C, Em	13.2	Failure to insure	En. C
53	Day works	En, C, Em	14.1	Dispute resolution	Em, C
54	Cost of repairs	C, En, Em	14.2	Procedure for adjudication	Em. C
55	Completion	C, En,	14.3	Replacement of adjudicator	Em. C
57	Statement at completion	C, En, Em	14.4	Arbitration	Em. C
58	Operations and maintenance manual	C, En, Em			
59	Termination	C, En, Em			
60	Payment upon termination	C, En, Em			
61	Property	C, En, Em			
62	Release from performance	C, En, Em			
63	Provisional sums and nominated subcontracting	C, En, Em			
64	Suspension of works	En, C, Em			

Notes:

- I. The Employer is not directly involved in contract administration, but through the Engineer. The Employer has to be made aware of; but need not be involved in approvals or decisions unless involving a cost or time change from the agreed scope, because the Engineer has no authority to change the contract. The Employer has been marked as involved in the table because payments are made by the employer on recommendation by the Engineer
- II. A few items show the Engineer being omitted. The Engineer has no direct role but may **assist the Employer on request** for checking or advice
- III. The contractor is involved in most items relevant for the Engineer as he has to receive instructions or do work, provide data etc.

### 3. Cost, quality and time

#### 3.1 Cost

- 3.1.1 Cost expected of a project is known from the BOQ value less **day works** bill, **provisional sums** and in some BOQs **provisional quantities**
- 3.1.2 An estimate being an estimate, final quantities may be increased or decreased to some extent depending on the accuracy of the estimate
- 3.1.3 Accuracy of the estimate will depend on the level of details in drawings; if type drawings are used, availability of site data will affect the accuracy in calculating quantities
- 3.1.4 Variations occur due to change of drawings, unforeseen conditions, new thoughts and requests by the employer [or the public requests, in case of roads and irrigation etc. but not for building projects]
- 3.1.5 A variation may be issued by the Engineer on a need, with the employer's consent. Generally, Variation approval by the employer is after knowing the total cost estimate. For this the approximate quantity and the rate should be known. If the work in the variation is quite dissimilar to work items in the BOQ, a new rate has to be obtained from the contractor and negotiated to clear any doubt. Preferably as the contractor's cost proposal, indicating any new inputs, change of methods, extra time involved. Otherwise, the contractors come out with nice stories, when commitment had been made and often unhappy endings are inevitable.
- a) If the work cost can be worked out using one or more BOQ item rates, the Engineer will determine or ask the contractor to follow the relevant contract clause and propose the new rate, which after verification and acceptance or modification, the variation order will be prepared by the Engineer and
  - b) with the contractor's signature
  - c) send to the employer to sign for approval and
  - d) then issue formally to the contractor.
- 3.1.6 If the contractor is not dependable, the Engineer should not instruct, or allow commencing work pending approval, until cost etc. are agreed; in some standard conditions of contracts, it is stated to start work after approval. Also, any work that will need to match with the varied work should not be started, so that **a situation will be created that the varied work cannot be avoided**. There are many occasions of such actions, which lead to dispute situations.

- 3.1.7 Actual upper bound cost of a project is known at the time of statement at completion [SAC]. The contractor can give any other costs he expects under the contract in SAC. These may be agreed or rejected after discussions. Such will be disputed if not resolved, before taking over or at least submitted before taking over.
- 3.1.8 **Final cost of a contract is known only after the final payment is settled, if no dispute notice is given**

## 3.2 Quality

- 3.2.1 Quality of a finished work has two components, i. e. strength and durability; finish and appearance. These are given in specifications as material, work requirement, tests and test frequency, tolerances etc. The appearance is not defined but it is felt by experience and practice in the industry in the country or the locality. **At present the workmanship part is forgotten and people try to show everything as good by tests. This is a wrong approach.**
- 3.2.2 Finish and appearance cannot be described 100 % correctly. In old engineering practice the phrases “as directed by the Engineer”, “as accepted by the Engineer” “to the satisfaction of the Engineer” were used
- 3.2.3 The quality requirements of commonly used items in road and bridge construction requirements are given in general specifications as in **CIDA publication, SCA / 5 - second edition June 2009.**

Serial No	Description	Section No.	Remarks
1	Arrangements for traffic with safety precautions	103	May or may not be a pay item as selected by the person preparing the contract document
2	Control of works	104	Not a pay item but it is the responsibility of the constructor
3	Control of Materials	105	This is important as quality of the finished product will depend on input materials
4	General rules for measurements and payments	106	This is not a quality requirement but is related in some cases as measurements are to be taken before being covered by the next operation
5	Workmanship and quality control	109	This is an overhead cost for the constructor, unless otherwise paid under some selected items. Necessary funds, equipment, personnel, testing, laboratory, and time should be allocated.

			<p>Specifications give minimum test frequency. This has to be preferably increased until the quality control is satisfactory.</p> <p>The Engineer may instruct to do so. And should not be questioned.</p> <p>Also, the constructor can propose to reduce test frequency if the Quality control is good. The proof can be made by showing all tests [including failures and repetitions e. g. field density test] that the mean less the standard deviation is well above the required value for the test. NEVER TAKE CHANCES ON THIS FOR MARGINAL SITUATIONS</p>
6	Standards	110	These should be followed for materials testing as required [SLS may be a good guide in selecting manufactured materials]
7	Services	112	<p>Protection, temporary shifting, relocation, alteration and addition are the responsibilities of the constructor but under the supervision and consent/concurrence of the service provider and employer</p> <p>May or may not be a pay item as the contract clauses are worded</p>
8	Protection of works and requirements to be met on already completed works	114	<p>This is the responsibility of the constructor</p> <ul style="list-style-type: none"> <li>a) to observe,</li> <li>b) to search</li> <li>c) to inform those relevant</li> </ul> <p>and act with responsibility and restraint</p>
9	Remedial works	115	<p>Should always be done informing the Engineer /Employer</p> <p>Should follow the Engineer's guidance</p>
10	Water supply arrangements	116	Responsibility of the contractor at his cost under overheads
11	Setting out, surveys and drawings	117	<p>This matters for dimensional, positional and levels accuracy.</p> <p>Serious attention is needed especially when level differences are so high, the naked eye will not see possible miss- alignments or level errors, [deep culverts or bridges]</p>
12	Provision of insurance and bonds etc.	119	<p>These should be done as required and re- validated before expiry and not needed for the employer/Engineer to remind.</p> <p>Insurance cover and regular payment of premium are important.</p>

			Insurance process itself is based on probability. Assuming zero probability can be done only in very rare insurance requirements and doing so will be foolish sometimes
13	Site clearing	201	<p>Purpose of site clearing is to remove obstructions for construction</p> <p>Clearing of vegetation and decayed matter is to avoid contamination of fill material as organic soils do not possess required strength and contamination reduces the strength of used materials.</p> <p>Organic materials absorb more water than selected soils and hence the reduction of bearing capacity of soil fills</p>
14	Property condition survey	204	This is important to avoid or face reasonably, to claims by the adjacent property owners as damage caused due to construction activities
15	Roadway excavation and sub grade preparation	301	<p>Roadway excavation is a single activity but considered under different pay items due to the nature of the material involved, depending on difficulty of excavation as well as reuse or disposal situations.</p> <p>Rock is defined as the material that cannot be excavated by other means except drilling and blasting. Any material that can be excavated using machinery is not hard rock. The standard method fixed is the use of ripper of a 150 HP crawler tractor to excavate. If not possible by this means rock is accepted as hard.</p> <p>301.3 b) requires rock excavation in road way to be a minimum of 0.2 m below sub grade and filled with suitable material. This suitable material can usually be the material specified for the next layer above.</p> <p>The purpose of this extra 0.2 m excavation and fill is because in bitumen surfaced road are flexible pavements. If one place is rigid then the road will be felt uneven under the use for long run when exposed to wheel loads.</p> <p>The excavated material shall be tested for deciding suitability for use in road construction. This may not be strictly done for each excavation but randomly done to ensure visual observation will not lead to wrong conclusions.</p> <p>The cost of such testing is not payable</p>

16	Excavation and backfill of structures	302	<p>The work includes the necessary</p> <ul style="list-style-type: none"> <li>-- - - diversion of streams,</li> <li>-- construction and subsequent removal of necessary cofferdams and cribs,</li> <li>-- necessary shoring,</li> <li>-- dewatering and pumping,</li> <li>-- removal of logs, stumps and other deleterious matter;</li> <li>-- obstructions for placing the foundations;</li> <li>-- trimming of excavations;</li> <li>-- backfilling;</li> <li>-- clearing the site of debris;</li> </ul> <p>and the disposal of excess materials</p> <ul style="list-style-type: none"> <li>• Note is to be made, In some contracts some of these are paid separately; there are pros and cons of such identifications. Also, many years ago, some of these were paid as separate items. When the Engineer's determination was challenged the methods changed, as the contractors started making misuse of these - may be with connivance with some Engineers.</li> </ul> <p>PLEASE READ Construction requirements listed in 202 .3 from a) to g).</p> <p>All excavations shall be according to the drawing and as directed by the Engineer; Measured in cu. m. for each layer of different material type.</p> <p>Any excavation in excess of the above other than what has been allowed by the Engineer shall be considered as done for the convenience of the contractor and shall not be measured for payments.</p> <ul style="list-style-type: none"> <li>• <i>Years ago, 2 ft. or 0.5 m were allowed as work space. This was misused as, due to depth more space is required, due to soil type more space is needed, due to side collapse more space is needed, extra excavation payment is cheaper than paying for shoring etc. So, this current method is selected and is good.</i></li> </ul>
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			<ul style="list-style-type: none"> <li><u>The contractor is expected to include these in his rates. It means the contractor has to find the approximate volume he has to excavate for his convenience and calculate the actual to be paid and multiply his rate by the relevant ratio of actual excavation and excavation selected for payment</u></li> </ul>
17	Borrow excavation	303	<ul style="list-style-type: none"> <li>Approvals are needed from - the Engineer if material within ROW is to be borrowed, from GSMB &amp; CEA if from private land, if from state land from the Divisional Secretary and clearance from Forest Department and Archeological Department for no tress-pass on their interests</li> <li>The contractor should be satisfied before entering into the contract, of the availability of borrow pits and adequacy etc.</li> <li>Borrow material from external sources shall be, only if excavations within the project are not enough or not suitable.</li> <li>Borrow material should be in separate stock piles</li> <li>For opening borrows outside site, owner's consent, his proof of ownership, legal requirements on environmental and forestry laws should be submitted for approval by the Engineer</li> <li>The contractor should satisfy himself of the quality and quantity of the burrow and show the Engineer and get approval after joint tests too.</li> <li>Material in borrows are not uniform. There are layers; so, taking sample tests intermittently is a need, not to excavate marginal or unsuitable materials. Whitish material in borrows of lateritic type soil has more clay and will always give values outside acceptable limits in tests.</li> <li>Drainage of borrow is important for keeping it dry for vehicle movement, moisture in soil, and to avoid mosquito breeding. Also, the operation should not contaminate natural water paths</li> </ul>
18	Embankment construction	304	<ul style="list-style-type: none"> <li>Embankment fill material is defined of two types. Type I, has better bearing strength [CBR value] and plastic properties than type II. The better one is used in upper layer below the sub base material.</li> </ul>



			<ul style="list-style-type: none"> <li>• Construction requirements are given in 304.3 a) to l) in SCA/5 publication</li> <li>• Removal of top soil and compaction of in-situ soil is important because the top soil has humus, clay and decaying materials. They will not have the same bearing strength and with time will perish. Any slight settlement will cause minor cracks in the compacted soil mass, of the road platform. Water entering these during wet weather, will deteriorate the embankment.</li> <li>• Any high clay material found too should be removed. A test may be done to identify. But, if the material under the roller is moving down and heaving up it is an easy method to identify soft soil</li> <li>• Compaction of in-situ soil is needed because the natural soil is not as dense as compacted soil and if not compacted may settle later</li> <li>• Compaction of soil depends on type of soil and its properties, moisture content, compaction effort and layer thickness.</li> <li>• Moisture control is very poor in many work sites; Dust emanation under the rammer is a common sight. Supervisors and Material Technicians should be made to be vigilant on these as repeated testing and waste of compaction energy can be saved.</li> <li>• Wetting the stock pile is a forgotten art now. When the soil layer is wetted sticking to the roller is possible and time is wasted waiting for slight drying or compaction at low moisture levels is seen.</li> <li>• Layer thickness is easy to control, if stakes are fixed along the side and heights are marked.</li> <li>• If top finish of the layer for compaction is not sloping away or uneven, water puddles are formed after a rain and waiting to dry or scarification to expedite drying. are unnecessary waste of time</li> <li>• Back filling at structure [culverts] is critical because the fill height is the highest at this point. Any compacted soil can consolidate under load for long periods. The compaction force is by the</li> </ul>
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			<p>rammer only. So, layer thickness control by marking on the abutment and testing of each layer is essential, as it can be seen in many Sri Lanka roads, the subsidence at the culvert approach after a few years of road opening for traffic.</p>
19	Soft ground treatment for major projects	307	<ul style="list-style-type: none"> <li>• <i>The contractor has to review soil profile drawing, if provided by the employer.</i></li> <li>• The contractor has the right to ask for such information. If available the employer is bound to give.</li> <li>• The contractor has to investigate after agreeing with the Engineer if such information is not available.</li> <li>• The required soft ground treatment shall be proposed and agreed by the Engineer.</li> <li>• This work may include supply and installation of geo-textile, removing soft soil and rock or non-cohesive material fill, vertical band drains, Gravel mat, <u>sand/gravel compaction piles, and pile and slab embankment construction.</u> The first two are common in road work even in limited patches.</li> <li>• Sand gravel pile OR pile and slab embankment are rare and when roads run across marshes, these will be used. [Katunayaka expressway crossing Muthurajawela section is one such in Sri Lanka]</li> </ul>
20	Sub bases, bases and shoulders	400	<ul style="list-style-type: none"> <li>• The materials are specified in 1708.2 in the same book.</li> <li>• The materials are less cohesive LL and PI are 40 and 15 respectively.</li> <li>• Shoulder is constructed as edge support for the pavement layers.</li> <li>• Earthen road shoulders are on either side of the pavement.</li> <li>• The shoulder shall be constructed of uniform material through its depth</li> <li>• The depth of shoulder material is equal to or more than the bottom of the less cohesive base material layer</li> </ul>

21	Dense Graded Aggregate Bases	405	<ul style="list-style-type: none"> <li>• This work consists of providing Dense Graded Aggregate Base {ABC AS COMMONLY KNOWN} on a prepared sub base or existing paved surface.</li> <li>• The material shall be graded crushed rock of nominal size 37.5, 28 or 20</li> </ul> <p><i>[Please refer sub sections of 1701.3 (a) and grading requirement table 1701.5 of sub section 1701.3 (b)]</i></p> <ul style="list-style-type: none"> <li>• The non- pervious surface of the existing paved surface should be damaged so that any moisture [water] will not be entrapped in the layer. The existing pavement layer should not be damaged because the strength of it will be reduced and if the design is done considering the already stabilized base the finished work will be different from the designer's expected base strength.</li> </ul> <p><i>[please refer to section 1601.3.and 1601.4. for tolerance limits]</i></p> <p><i>[It is safer to avoid maximum allowed plus side value, as undulation will fail in surfacing layers as tolerance allowed is reducing in each layer above]</i></p>
22	Penetration macadam bases	406	<ul style="list-style-type: none"> <li>• Penetration macadam ['penmac'] consists of one or more layers of compacted coarse aggregate with alternate applications of bituminous binder and key aggregate</li> <li>• This is a base layer formed on a prepared sub base or a paved surface,</li> <li>• The aggregate is laid and rolled lightly till it is well set on the most stable position and the surface is fairly smooth. Bitumen is sprayed under pressure, so that it will penetrate in to the voids of the aggregate layer; and hence the name penetration macadam.</li> <li>• Macadam is sprinkling tar/bitumen on rolled aggregate named after Macadam who first introduced the process after Telford who found, stones and cohesive soil to be spread and rolled by static roller pulled by horse or bulls in early road construction.</li> <li>• Materials are coarse aggregate of nominal maximum size 50 or 37.5 mm with key aggregates of size 20 mm or 14 mm.</li> </ul>

			<p>[please refer <i>sub section 1701.3 (a) and the grading requirements of the table 1701.7 in sub section 1703 (b)</i>]</p> <ul style="list-style-type: none"> <li>• Bituminous binder generally used is, 80 – 100 penetration grade bitumen or 10 – 20 percent cut back bitumen or bitumen emulsion CRS-2</li> </ul> <p>[ <i>reference 406.2 and section 1702</i>]</p> <ul style="list-style-type: none"> <li>• Cut back bitumen is a mixture of bitumen and diesel or kerosene oil; percent value is the amount of diesel or kerosene oil added</li> <li>• The key aggregates are spread over the surface after bitumen is sprayed and lightly rolled with a smooth roller so that the key aggregates will be positioned in the gaps of coarse aggregates and well set as a homogeneous layer of aggregates and binder</li> </ul> <p>[please refer to section 1601.3.and 1601.4. for tolerance limits]</p> <p><i>The layer will be like “pani kaju”- the sweet made of ground nuts [‘ratakaju’] and honey</i></p>
23	Prime coat	501	<ul style="list-style-type: none"> <li>• This is an application of a bitumen coat on a newly constructed base or sub base</li> <li>• The base material may be gravelly soil, stabilized soil, or aggregate.</li> <li>• To provide a proper bond between the layers and also to serve as a protective measure for the base or the sub base, prime coat is given prior to the laying of a surface dressing or a surface course.</li> <li>• The binder is generally of medium curing cut back bitumen [25 to 45% cut back] MC 30, MC70, MC 250 complying with sub section 1702.2 or bituminous emulsion of grade CSS-1 or CSS-1h [please refer to sub section 1702.3]</li> <li>• The indicative rate of spread of cut back bitumen or emulsion for the prime coat are in the range of 0.5 to 1.5 liter /m<sup>2</sup> [please refer 501.2]</li> </ul>
24	Seal coat treatments	505 B	<ul style="list-style-type: none"> <li>• The work is construction of Single Bitumen Seal Coat [SBST] or Double Bitumen Seal Coat [DBST] on existing bituminous surface.</li> <li>• This is a wearing course. This wears off by traction of wheels, saving the base unaffected.</li> <li>• Normally emulsion or hot bitumen is used.</li> </ul>

			<ul style="list-style-type: none"> <li>• Triple seal treatment where required shall also be constructed according to these specifications but the aggregate sizes and rates of spread of aggregate and binder will be different</li> <li>• The operation is application of binder followed immediately by spreading of single sized aggregate and compacting with a pneumatic tyred roller [PTR] or any other approved by the Engineer.</li> <li>• Steel rollers are not used as they may cause crushing of smaller aggregates [please refer to section 1601.3.and 1601.4. for tolerance limits]</li> </ul>
25	Asphalt concrete surfacing	506	<ul style="list-style-type: none"> <li>• This is a wearing course. This wears off by traction of wheels saving the base unaffected. The base material is relatively less cohesive and can disintegrate by wheel action.</li> <li>• Sometimes a binder course is also provided.</li> <li>• If it is on an existing bituminous surface with high level of irregularities a correction layer is done first, which has a varying thickness when an even surface is formed by spreading asphalt concrete.</li> <li>• The asphalt layer has binding property due to bitumen in it. The layer is a one single mass, once formed. Asphalt is produced in a central mixing plant and is transported to site and spread and rolled</li> <li>• Asphalt is a mixture of aggregates, fines and bitumen in required proportion and at a prescribed temperature.</li> <li>• Asphalt production is a serious process and section 506 should be carefully studied [please refer to section 1601.3.and 1601.4. for tolerance limits]</li> <li>• Table 1601-1 gives Tolerances of Surface Regularity requirements</li> </ul>
26	Sub surface drains	702	<ul style="list-style-type: none"> <li>• Construction of sub surface drains [under drains, trench drains] is done using perforated pipes, non-perforated pipes, geo-textiles and granular filter materials.</li> <li>• These are provided when ground water table is rising to the road base due to small springs underneath.</li> </ul>

			<ul style="list-style-type: none"> <li>• This is common in high cut sections during rainy seasons the water from the high side /hill, percolates underneath the road and reduces the bearing strength of the base or water oozes out on to the road surface.</li> <li>• The most important part is the outlet of the sub surface drain. It should allow the water collected to be drained off at a faster rate than the water is collected in to the drain from the surrounding. [Refer to section 702.2 and 702.3 for details on materials and construction method]</li> </ul>
27	Weep holes for earth retaining structures	706	<p>706.1 “This work shall consist of providing openings in earth retaining structures to facilitate the drainage of any water collected at the back of the structure, as given in the drawings or as directed by the Engineer”</p> <p>“Weep holes may be cast in-situ or pipes embedded in the structure”</p> <p>“They shall be protected during construction and cleaned before backfilling is placed behind the structure”</p> <p>Note should be made that the specification does not include aggregate backfill which is normally paid separately.</p> <p>While back filling, if the hole is fully closed the purpose of providing it, is lost. However, the hole should be opened for the water to leak out. In practice a big stone is placed at the mouth of the opening and earth is filled so that the earth will not block the opening and there will be some small gap(s) for the water to leak.</p> <p>But this is not an effective method in the long run. The soil moves with water and with time the hole is filled and the effectiveness of draining out is reduced.</p> <p>The bad effect of it is, if the designer having provided weep holes has made the calculation assuming fully drained conditions. Thus, when the soil is wet and saturated, the factor of safety of the design is reduced because the wet soil has a bigger density and hence exerts a higher active pressure on the wall.</p> <p>So, the provision of the aggregate fill or the filter material is important.</p>

			<p>These are shown in drawing and BOQ provides item; so that this work will be done satisfactorily.</p> <p><i>However, in home gardens when retaining walls are made these are not done well and in hilly areas partial collapse of retaining walls is common during every rainy season.</i></p> <p>In many drawings the aggregate fill is to be placed on a layer of <b><u>puddle clay</u></b>.</p> <p>The purpose of puddle clay layer is for the percolated water down the soli mass especially along the interface of the wall and soil to be trapped from moving further down and be led out through the weep hole.</p> <p><u>Puddle clay layer should be impervious to be truly effective. So, it should be high clay. It should not have cavities, cracks or gaps. Thus, the clay should be well powdered and mixed with right quantity of water to be spread as homogeneous continuous layer. This is a very difficult work.</u></p> <p><b><u>These were done when polythene was not in use.</u></b></p> <p>Providing a hard polythene layer instead will be simple, cheap and effective.</p> <p>Even the aggregate fill with time may be clogged by the small particles of soil moving with the percolating water in the long run.</p> <p>Therefore, the aggregates can be placed on a geo-textile with suitable pore size and after filling the aggregate as required and be covered with the geo- textile as a wrapping and this will keep the aggregates unclogged for many years.</p> <p>IT IS HIGH TIME FOR THIS STANDARD DRWING FOR AGREGATE FILL BEHIND WEEP HOLES TO BE CHANGED</p> <p>In some drawings it is not mentioned that the aggregate fill should be continuous. This is required as percolation in horizontal direction cannot be expected unless pore pressure is developed. Development of pore pressure is not expected in the design, if well drained soil is considered in the design.</p>
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			<u>So, a continuous drainage filter should be shown in drawing or in specification or as direction by the Engineer</u>
28	Gabion walls & mattresses using wire baskets	805	<p>805.1 “This section covers the construction of gabion walls and mattresses for the construction of retaining walls, lining of channels, revetments, aprons and other anti- erosion structures in hill slopes embankment slopes and stream banks etc.”</p> <p>These are made of mesh in box or mattress shape to be filled with rock /rubble.</p> <p>Stone packing in the box is same as rubble masonry but without mortar. Gaps in bigger stones are filled with smaller stones or flats - the size to be bigger than the ‘eyes of the mesh’. The filling if loose, the box may deform easily and it may affect the stability of the wall if wall is tall.</p> <p>Stability of gabion wall is by its weight and bottom friction only. There is no passive pressure to support the gabion wall against the active pressure of soil mass retained. The active pressure is always from a well - drained soil as the wall allows all percolated water out at all times.</p> <p>The gabion box is buried for a depth less than half height of the bottom box to ensure side erosion will not upset the seating of the bottom of the base and causes no tilting only.</p> <p>The advantage of a gabion box is, even if there is slight deformation about 100 to 150 mm, the effect will be seen but there is no alarm in public mind as seeing a crack in a conventional retaining wall which will show a crack with less deformation / tilt or displacement effect</p>

### 3.3 Time

3.3.1 Time for completion of a contract is given in the contract data

3.3.2 The contractor should submit his construction program accordingly, together with resources schedule, cash flow diagram and an overall method of construction; a detailed method statement may be given at the start of complex and involved works. A bar chart or a network diagram only shows the time sequence of



operations and shall not be accepted as a complete program. **The bar chart too should be a linked bar chart to identify the critical path of activities**

- 3.3.3 The Engineer should carefully study this program for acceptance, because the progress monitoring and this program will be the basis for time extension assessments. The Engineer has to pass his observations for the contractor to correct the program. Some contractors send this correction as revision. The revision of a program occurs when the accepted program is changed on circumstances only. **Until acceptance any correction or change is a CORRECTION and will NOT BE A REVISION under the contract.**
- 3.3.4 The progress based on this has to be monitored at least once a month, to assess the percentage progress achieved on each activity whether it is critical one or not, because if non critical activities are delayed too much, they may fall into the critical path.
- 3.3.5 Availability of planned material stocks, man days used, machine hours/days used etc. should be compared with achieved progress. If there is a gap more than 10%, [leaving for any calculation or assumption error] the situation is getting out of control and attention could be called of the contractor as well as the Employer.
- 3.3.6 Continuous shortfall of progress for 2 or 3 months should be discussed at the progress review meeting; contractor should be directed to revise the program keeping to the original target dates unchanged for final completion, unless there are solid reasons for an extension of time. So, the contractor will have to increase inputs or work hours for a day, more than the standard times under labor laws. These will lead to overtime payments, night work arrangements, extra payments to supervision staff etc. The Engineer has to study the revised program carefully using his knowledge and experience.
- 3.3.7 Even after the revision of program **if the contractor fails to keep with the progress required, warnings and notice to correct should be issued** and the contract termination should be carefully planned, as any contractor will go for dispute resolution process, when terminated. The Engineer should follow the contract document carefully with any contract; the moment repeated delays and bad performance is noticed. Early warning letters should be sent; ensure that letter delivery is by registered post or hand delivered with receipt records. The delay damages should be informed without delay; but may not be imposed hurriedly unless a decision on termination is taken but not informed to the contractor. Then the contractor gets the message to perform better. Later at the completion any concession may be given. If action is not taken in time, there will be more problems. **If termination is the solution, be hard without wavering and finish the process without delay.**

- 3.3.8 If compensation events occur the contractor is entitled for EOT. So, the Engineer has to record the events which are in favor as well as those against the contractor, if the contractor is not actually making effort to perform well. Most dispute resolution processes are started late as parties do not employ the adjudicator from the beginning to save money. But then the matter will be decided only on available records. Any record which is not jointly prepared and signed or accepted will **not be considered a fact**. So, records are important. Such joint records done when the event is happening or just past, are only considered as **contemporary records**
- 3.3.9 If the Engineer has not initiated, the contractor shall give notice and thereafter start keeping records and bring to the notice of the Engineer and joint records should be maintained. If not, the contractor will be considered to have given up his rights.
- 3.3.10 The Engineer should consider all fair compensation events and recommend EOT. But if the contractor is not performing and the delays are his, matter should be dealt promptly by writing the required letters to establish that the compensation event is not the reason for delay.
- 3.3.11 No contract document should be rigid to say the completion has to be on a fixed date, regardless of events beyond the control of the contractor. Though such agreement is signed, if compensation events do occur, he will get extra time in a dispute resolution under natural justice or fairness. The argument is that, after such event the contract period becomes undefined and then the delay damages cannot be imposed. Then later interest payments too will add on.
- 3.3.12 The Engineer [or the person who prepares the contract document] should provide a practical completion period. Ideal working conditions should not be assumed to fix contract period. The best method will be evaluating the required period under ideal conditions and allow 25 % extra time in fixing contract period itself.
- 3.3.13 When dispute situations are felt likely, the parties should be careful to write proper contractual letters, stating the relevant contract / specification clauses, the event and the reasons that lead to the situation, with reference to any records etc. Site records should be available for this type of contractual letter as support documents.
- 3.3.14 Disputes should be referred for resolution without delay. The delays will cause the defending party to pay interest. But it is always good to resolve amicably but promptly [within limits of integrity]

#### **4. Risk management and insurance**

##### **4.1 Risk management**

- 4.1.1 Risks in construction are, damages to people and property, movable or immovable.
- 4.1.2 People may be, people involved in the project or outsiders; outsiders are termed third party.

- 4.1.3 Most common and sensible ways for risk management are;  
(a) taking precautions to avoid or minimize loss or damage  
(b) obtain insurance cover for all possible situations. When more possibilities are included for insurance, the cost or the payment known as premium is high; but all probable situations should be covered
- 4.1.4 Means of losses are theft and pilferage, for materials. These can be avoided or minimized by proper security and correct material management systems. Means of damage are, perish by improper storage, collapse of heaps etc. stacked in unsafe manner. Wrong methods of handling, lifting, machinery movement etc. can cause damage to other materials, or completed or part completed works.
- 4.1.5 Methods to avoid these are covered in industrial safety manuals. [Best will be for the employer to arrange seminar with the Safety Engineer of the labor department. There is an officer attached to every provincial office of labor department]

## 4.2 Insurance

- 4.2.1 In construction, insurance cover is taken generally for,
- Outsiders as third -party insurance; as minor injury partial or complete disability or death – a minimum cover is given generally 1 million for death.
  - Works to cover all finished and unfinished works for the contract sum or the sum + 10 to 20 % additional.
  - Workman compensation cover is prepared by all insurers as per the workmen's compensation act. The payments are accordingly and it is difficult to make them agree for any changes [Author tried and failed 20 years ago]. The payment is only for the days the worker is not attending for work. Disability - even partial cannot be proven; it is very tedious to provide medical reports etc.
  - Vehicles and machinery cover is required; vehicles are required to be insured to put to the road. But contractors are great violators of law. So, the Engineer should see this. Machinery insurance is not compulsory by law, so this aspect is to be checked. Major companies have a common cover for all their machinery. A copy of such has to be asked for checking as some times these are lapsed because of delay in payment of premium.
  - If the premium is not paid at the date of the event that need be compensated, the insurance company refuses to pay.
- 4.2.2 The Employer should state the minimum insurance cover required for each category, in the contract document, also possible events that should be covered. The minimum payments indicated should be for any number of events and if not so covered the employer has to bear the cost, if a third party is involved. But the insurers do not agree for such open- ended limits. Then it is the contractor to agree

- with the insurer for a number which is probabilistically adequate by the experience of the insurer. The employer / Engineer should accept the cover; but in the acceptance, it should be indicated, if the allowed number of events occurs; **additional cover should be again taken by the contractor at his cost. If not, the contractor will have to bear the cost of damage in case another happens.**
- 4.2.3 In the insurance clause, it should be stated that the contractor is responsible for any payment of the damage, if the insurance has not been renewed by the end of validity period. Generally, insurance cover is taken for the full contract period or more but if time extension is given; these are to be extended. Some insurers propose 01year cover to be extended. This may be allowed but if not extended the insurer refuses to pay for any occurrence after that date.
- 4.2.4 In case of road or utility construction contracts, work is in public places. Damage to adjacent property or persons are very likely to happen. So, getting the insurance cover is difficult. These contract clauses should be carefully worded to cover all possible situations. The tendency of the public is to sue the state organization, than the private party as the owner of the works. The contractors leave the area but the state agency is there forever. The court cases are delayed and the best way is to sue the state agency and not the contractor etc. So, lawyers make it BEST for their clients' interest.
- 4.2.5 The insurance policies have exclusion and subjective clauses written in small font for different sections or sub clauses in the printed policy. These have to be studied carefully. If not, when a claim is submitted the insurers show these clauses and refuse to pay. Subjective clauses are only mentioned as some provisions. The detail is in their documents as company policy or manual. So, the relevant clause should be asked for verification of acceptability of the insurance policy to avoid bad experience in case of an event of damages payment.
- 4.2.6 Payment for obtaining insurance cover is given as lump sum in some and provisional sum in other contract BOQs. If it is lump sum, if the insurance cover is accepted the payment is easy. But for provisional sum, at every stage of payment, a support document from the insurer for the premium payment, has to be obtained. But when the lump sum is used, when a time extension is given and extension of the validity of insurance cover is required; contractors claim the additional premium cost again stating that he priced the lump sum for the period expected for as known at that time of bid and extension of time approved is a new situation. So, provisional sum method is better.
- 4.2.7 Always the contractors do price high, for these lump sum items as sure payments. But if lump sum payment is preferred, in particular conditions it should, be mentioned that the contractor should consider possible future events and make a

full compensation and no second payment will be made over and above the stated lump sum.

[To know more details in depth on insurance, advice of Insurance consultants may be sought]

## **5. Securities /bonds**

5.1 Bonds or securities required in construction are,

- a. Performance security
- b. Mobilization advance guarantee / security

5.2 For both these the standard forms are given in ICTAD documents. Value and the period are given in contract data. The contractor has to ensure the bank gives the security following the format given and the employer/Engineer has to see the requirement has been followed without making change to the meaning. Some may not be the exact wording but care should be taken to check the content.

5.3 Both these should be unconditional bonds to be paid on request without reservations. In checking for acceptance, this aspect should be checked and found satisfied.

5.4 The bank that issues the bond has to be acceptable to the employer. The contractor cannot bargain on this if the employer disagrees. But unless previous known situations are there, bonds issued by any government accepted bank shall not be refused.

5.5 A common problem is that the expiry date of the bond is forgotten by both parties. The QS should make an excel sheet to keep information about the securities indicating the number, issued institution, value, issued date and expiry date which should be updated. As a practice when the original contract period is over it should be checked by QS and at the preparation or certification of every IPA.

5.6 The Employer as a practice should verify with bank or preferably the main office of the bank whether such a bond has been officially issued by the bank. There was a case of a contractor getting a letter from a bank manager similar to a bond with bogus number and when the bond was called only, the truth was known.

## **6. Construction claims, site records and dispute resolution**

### **6.1 Construction claims**

6.1.1 A construction claim is a claim made in construction

6.1.2 A claim is a statement or a demand for something because you believe you have a right to ask for it

6.1.3 A construction claim is a demand for a right by the contractor in construction i. e. A demand for money or time additional to what has been agreed in the BOQ and the contract and should be according to agreed conditions in the contract

6.1.4 Any payment request within BOQ is not strictly a construction claim but in usage monthly claim -interim payment claim etc. are used to mean statements of right as

per BOQ. However, this usage is now discouraged to call the BOQ payments as 'payment application' and 'claim' is limited to those outside the agreed cost or time only.

- 6.1.5 Any claim has to arise out of a situation different from what is agreed in the contract, or not expected to happen at the time of bid. Such new situation is called an event or may be a series of events. The event may be a natural occurrence; an instruction, a social condition, a legal change, an unforeseen ground condition etc.
- 6.1.6 The event should have an effect on the contractor's already agreed performance. The effect on performance has to be established with facts. There should be a relevant contract clause under which the contractor can show that he has a right for a claim. When the contractor becomes aware of such a situation, he has to give notice to the Engineer of the event and his intention to claim. The notice has to be followed by a claim for cost or time or both.
- 6.1.7 The contract document stipulates broadly how the claim notices should be given and how a claim should be submitted. Both the notice and claim should be submitted as per contract. If not, the Engineer may reject the notice or the claim or be silent about it. The contractor can send reminders. And if no positive action is there by the Engineer, the contractor can inform of dispute resolution action.
- 6.1.8 If the Engineer responds after the correspondence on dispute resolution process, the contractor may step back and follow the claim procedure. In either case after informing of the event the contractor should keep joint records with the Engineer/ his representative. This is vital to support his claim.
- 6.1.9 A proper claim notice should include the event, the date or the approximate time of the event, its effect, under what clause he has a right to claim, whether he claims time, cost or both.
- 6.1.10 A proper claim will have a proper notice, cost or time values or both, how those values are calculated, the event and its effect on performance and relevant clauses at the relevant evaluation or establishing fact, support documents for proof of facts and narrative to establish the logic or the argument put forward.
- 6.1.11 When such a claim is submitted the Engineer should make his recommendation and inform the employer for consent; if the consent is not to be given the contractor should be informed by the employer himself or by the Engineer. The Engineer being an impartial person can give his determination even if the Employer disagrees. But the determination is not an approved EOT or approved claim. It is only a determination only, if the Employer disagrees.
- 6.1.12 The Employer or the contractor can refer this to the adjudicator at this stage and the determination will be upheld, amended or rejected by the adjudicator and the

parties will have to agree to the adjudicator's decision and not the Engineer's determination at this time.

## 6.2 Site records

- 6.2.1 Site records are of two main types i. e. routine - daily or weekly or monthly records, event related special situation records
- 6.2.2 Routine records are agreed records in QA plan and method statements. Event related records are mostly leading to claim situations. But routine records too may be used to evaluate claims as data for calculations or proof.
- 6.2.3 Routine records are daily programs, request for inspection, test reports, level sheets, joint work measurements, weather records etc.
- 6.2.4 Event records are unusual or special ones of events such as faults, damages by outsiders, e. g. utility authorities. These will give the contractor right for claims depending on circumstances and how the contract clauses are worded in particular conditions.
- 6.2.5 The records prepared jointly or shared, are to be done at the time, not belated. Such timely records are called contemporary records. These are considered support documents for proof of facts of events which will be compensation events and **keeping proper joint records is vital.**

## 6.3 Dispute resolution

- 6.3.1 The contract stipulates the methods of dispute resolutions
- 6.3.2 If a party is dissatisfied with a determination by the Engineer, the party may refer to the adjudicator already established. If not, the party should immediately take action to set up the dispute adjudication board, - sole [= single] or 3 -member as per contract.
- 6.3.3 The parties should sign an agreement with the adjudicator a tripartite [3 party] agreement.
- 6.3.4 Inform the adjudicator, the need for the adjudication.
- 6.3.5 Submit the statement of claim to the adjudicator with a copy to the other party.
- 6.3.6 Adjudicator will hold a preliminary meeting and agree tentative program for the resolution process.
- 6.3.7 The other party will submit the statement of defense / response.
- 6.3.8 The claimant will be given an opportunity to reply to the statement of defense.
- 6.3.9 The other party i. e. the respondent also will be given a chance to reply, to the claimants reply to the statement of defense. It is called the rejoinder.

- 6.3.10 Then the parties or the adjudicator will frame issues and the parties will agree the issues are adequate or add any more as required. Once all feel no more, the hearing will be decided for the date, place and time.
- 6.3.11 The hearing will be conducted by the adjudicator and the decision will be delivered to the parties.
- 6.3.12 If a party is dissatisfied, he should give reasons and inform dissatisfaction to the adjudicator and the other party, within 28 days of the decision as per the contract clause. The next step is arbitration
- 6.3.13 ARBITRATION process too should be done as per contract conditions.
- 6.3.14 Similar process is followed and the arbitration tribunal is set up, sole arbitrator or a panel of three.
- 6.3.15 The arbitration will be conducted as per arbitration act 1995 of Sri Lanka.
- 6.3.16 The decision of the arbitration which is called **the award is final and binding.**
- 6.3.17 If the arbitration award is not obeyed the affected party can refer the matter to high court for implementation. If the high court order is not followed punishment will be, for not obeying the law or contempt of court.
- 6.3.18 **Arbitration award can be challenged only on 4 counts which are given in arbitration act; this challenge can be done in a high court. More details of these are beyond this topic.**

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## **Chapter 5 - The role of the Engineer in a construction contract**

### **A. The role of the Engineer in a construction contract**

1. A construction contract is an agreement commonly between two parties to do a construction and to make payments when performed on agreed conditions.
2. Construction being a complex matter the owner or the employer engages a specialist who knows construction as the employer's advisor or guide, referred to as the "Engineer for the contract."
3. Also, the conditions are laid for the contractor to obey the Engineer on contractual matters.
4. Therefore, the contractor expects the Engineer to be fair and within the conditions agreed by the parties.
5. Thus, the Engineer is considered to be acting independently and reasonably while serving the employer and being paid by the employer.
6. Therefore, the Engineer is defined in the contract conditions and his role, responsibility and authority are given in a separate clause(s). Yet he has to do some works not defined under the Engineer but elaborated under the contractor's responsibilities generally referred to as obligations of the contractor. There are other clauses as communication common to both parties. So, the Engineer's role is spread in many clauses of the conditions of contract.
7. BUT THE ENGINEER IS NOT A PARTY TO THE CONTRACT.
8. Different contract documents present these clauses in different ways. In Sri Lanka ICTAD conditions of contract SBD 01, 02 and 03 are commonly used in state sector projects, if Sri Lanka funds are used. FIDIC MDB version is used when international donors' funds are used.
9. So, the writer selects the clauses in these documents and summarizes only the part the Engineer has to do under each relevant clause in a table form.

b. Role of the Engineer in a construction contract – Contract clauses in Tables

TABLE 1

SBD 01 [2007]			SBD 03 [2006]		
Sub clause No.	Title	Engineer's involvement	Sub clause No.	Title	Engineer's involvement
4	Engineer's decision	Engineer will decide contractual matters between the Employer and the contractor in the role representing the Employer	2.3	Engineer's instructions	All instructions are to be given by the Engineer in respect of the Works including suspension of all or part of work
5	Engineer's representatives	Engineer can appoint his representatives and delegate duties and responsibilities of authority vested in him	2.4	Approvals	Non –approval, non-consent or absence of comment by the Engineer/Employer shall not affect contractor's obligations
6	Communication	Within 7 days any verbal communication including instruction shall be confirmed in writing. If not contradicted within 7 days, the communication is considered accepted by the other party.			
7	Subcontracting	The Engineer's approval and Employer's approval in writing are required for subcontracting	3.1	Engineer's decision	Except where otherwise specifically stated the Engineer will decide contractual matters between the Employer and the Contractor
9	Personnel	The Contractor's key personnel shall be approved by the Engineer If the Engineer asks the contractor to remove a person from his staff giving reasons, the contractor should oblige. The person			

		should be removed from site within 7 days			
13.3	Insurance	The Engineer shall receive insurance policies for approval before the start date	4.3	Sub contractor's work	Engineer has to consent for sub contract the whole or any part of the works
13.5		Alterations to the terms of an insurance shall not be without the Engineer's approval	6.2	Program	Program is to be submitted to the Engineer, in a form acceptable to him
15	Queries about contract data	The Engineer will clarify queries on contract data	6.3	Extension of time	On receipt of an application, the Engineer shall consider all supporting details and extend the intended completion date as appropriate
16	Contractor to construct the works	The contractor shall construct in accordance with the specifications, drawings and the Engineer's instructions			
17	Works to be completed by the intended date	The contractor shall carry out the works in accordance with the contract according to the program with the approval of the Engineer	7.1	Completion	Engineer has to receive the notification of completion as considered by the contractor
18.1	Approval by the Engineer	Specifications and drawings for proposed temporary works shall be approved by the Engineer	7.2	Taking over	Inform the contractor the date the Engineer considers the work is complete Inform the date he is ready to take over even if not fully complete
18.3		The Engineer's approval shall not alter the contractor's responsibility for design of temporary works	8.1	Remedying of defects	Notify the contractor, defects to correct or outstanding work before the expiry of defects liability period. Inform the employer to attend defects if the defect or incomplete work is not attended

					by the contractor within reasonable time.
18.5		All drawings prepared by the contractor for temporary and permanent works are subject to prior approval of the Engineer	8.2	Uncovering & testing	May instruct to uncover or test any work Unless the uncovering or test shows the work is not in accordance with the contract the Engineer will recommend payment for the expenses as a variation
20	Discoveries	The contractor shall notify the Engineer of discoveries and shall carry out the Engineer's instructions for dealing with them	9.1	Right to vary	The Engineer may instruct variations
22	Access to site	The contractor shall allow the Engineer and any person authorized by the Engineer access to site and to any place of work related to the contract	9.2	Valuation of variation	The Engineer can instruct variation as a lump sum, agree new rates or fix appropriate new rates
23	Instructions	The contractor shall carry out all instructions given by the Engineer which comply with the law where the site is located	9.3	early warning	Receive early warning or give a warning on behalf of the employer with his concurrence
27.1	Program	The contractor shall submit to the Engineer the program for approval	9.5	Variation and claim procedure	Receive contractor's itemized variation claim within 28 days of the event giving rise to claim, check, agree or determine the value
27.3		The contractor shall submit the updated program for the	10.2	Valuation of works	The Engineer has to check within 14 days of receipt of

		Engineer's approval at intervals no longer than as stipulated in the contract data			contractor's monthly statement
27.4		If the contractor does not submit the program as per clauses 27.1 and 27.3 the Engineer may withhold the amounts stated in contract data from the next IPC	10.6	Final payment	Receive the final account within 42 days of the events listed in sub clause 10.5 Certify within 28 days and give reasons for any disagreement
27.5		The Engineer's approval of program will not alter the contractor's responsibility. The Engineer's approval may be requested any time for revised programs on effect of variation or compensation events	10.9 (g)	Price adjustment	If the input percentages are unreasonable, unbalanced or inapplicable due to variations and additional works executed or instructed under sub clause 9.1 The Engineer shall adjust the input percentages
28.1	Extension of intended completion date	Engineer shall extend the intended completion date if a compensation event occurs or a variation is issued, which make it impossible to complete the works on intended date without taking steps to accelerate the balance work	10.10	Subsequent legislation	The Engineer shall determine any reduced or additional cost arising as a result of subsequent legislation. No separate payment shall be for these if the change has been covered by price adjustment formula
28.2		The Engineer shall decide whether and by how much the intended date is to be extended within 21 days of request by the contractor. If the contractor failed to give an early warning	11.1	Default by contractor	The Engineer shall issue notice within 14 days on contractor's default

		of a delay such delay need not be considered.			
29.1	Acceleration	When the Employer wants the contractor to finish before the intended date of completion the Engineer shall obtain priced proposal from the contractor	11.2	Default of the Employer	The contractor can give notice to the Employer on default if the Engineer does not carry out his obligations
30	Delays ordered by the Engineer	The Engineer may instruct the contractor to delay the start or progress of any activity within the works	11.4	Payment upon termination	Net balance due to the contractor has to be evaluated and certified for payment
31. 1	Management meetings	Either the Engineer or the Contractor may require the other, for a management meeting			
31. 2		The Engineer shall record the business of the meeting and send copies to those attended and the Employer. The Engineer shall decide the parties to take action at the meeting or afterwards			
32.1	Early warnings	The contractor shall warn the Engineer at the earliest opportunity of specific likely future events that may adversely affect the quality of work, price or delay the works. The Engineer may require the contractor to provide as soon as			

		possible an estimate of the effect
32.2		The contractor shall cooperate with the Engineer in making and considering the proposals for how the effect of such an event can be avoided or reduced
33	Identifying defects	The Engineer shall check and notify the contractor of defective works specifying a time within which to remedy. The Engineer may instruct the contractor to search for defects to uncover and test any work the Engineer considers may have a defect
34	Tests	If the Engineer instructs to carry out a test not covered in Specs. Or BOQ, and the test shows material or workmanship is not defective the contractor should be paid the cost of test. If not, contractor should bear the cost
35.1	Correction of defects	The Engineer shall give notice to correct defects before the end of defects liability period
35.2		Every time the notification of defect is given correction should be within the specified

		time given by the Engineer
35.3		On completion of defects liability period and correction of shown defect, the Engineer shall issue the final certificate
36	Uncorrected defects	If the correction is not done in time specified the Engineer will assess the cost of correction and contractor will pay such cost [deducted from dues]
38.1	Change in bills of quantities	If the final quantity of work done differs from BOQ quantity by 25 % and cost by 1% of contract sum for a particular item the Engineer shall re-examine the rate considering market cost and allow for the changed quantity
38.2		The Engineer shall not adjust rates, if initial contract price is exceeded, without the approval of the Employer
38.3		If requested by the Engineer the contractor shall give a rate break up of any item in BOQ
39.1	Variations	The Engineer may issue variations any time before issuing the certificate of completion, as instruction or



		requesting a proposal from the contractor
39.2		The Engineer may issue variations up to the value given in contract data. Any variation above this value shall be with the approval of the Employer
39.3		The contractor shall execute the variation unless he has promptly notified the Engineer, refusing with his reasons for the refusal. Then the Engineer may re-confirm, vary or cancel the variation
39.5		The contractor shall not do any alteration or modification to permanent works unless and until the Engineer instructs or approves a variation
40.1	Payment for variations	The contractor shall give a quotation within 7 days or such extended time to the Engineer. The Engineer shall assess the variation before ordering the variation considering the provisions in the contract
40.2		If the work in variation corresponds with an item in BOQ and quantity is within the limits stated in sub clause 38.1, or timing does not cause the cost

		per unit quantity to change, the rate in BOQ shall be used. Otherwise, the quotation from contractor shall be a new rate.
40.3		If the contractor's rate is unreasonable the Engineer may make his own forecast and issue the variation. If the contractor disagrees, he may refer to adjudication
40.4		If the Engineer decides the urgency of varying of a work would prevent obtaining a quotation and the variation can be executed and it shall be a compensation event
41.1	Cash flow forecasts	When the program is updated, the contractor shall give an updated cash flow forecast to the Engineer.
42.1	Payment certificates	The contractor shall submit the Engineer, a monthly statement of, the estimated value of work.
42.2		The Engineer shall check and certify within 21 days of receipt
42.3		The value of work done shall be determined by the Engineer
42.6	Payment certificates	The Engineer may exclude any item

		certified in a previous certificate or reduce any proportion, in the light of later information
44.1	Compensation events	<p>d) The Engineer orders a delay or does not issue drawings, specifications, or instructions required for execution of works on time in spite of the contractor requesting for such information;</p> <p>f) The Engineer gives an instruction for dealing with an unforeseen condition, caused by the Employer or additional work for safety or other reasons;</p> <p>i) The Engineer delays the monthly interim payment certificate unreasonably;</p> <p>j) The Engineer unreasonably delays issuing the certificate of completion;</p> <p>k) The Engineer instructs the contractor to uncover or to carry out additional tests upon work which is then found to have no defects;</p> <p>l) The Engineer instructs the contractor to suspend progress of part or all of the works in accordance with sub clause 64.1 and the cause of suspension is</p>

		not the responsibility of the contractor; m) The compensation events described in contract data or determined by the Engineer;
44.2		If a compensation event would cause additional costs or extra time to complete, The Engineer shall decide a) by how much the contract price shall increase b) by how much the time for completion be extended
44.3		As soon as the contractor's forecast of cost on compensation event is provided the Engineer shall assess and adjust the contract price. If the contractor's submission is unreasonable, the Engineer shall use his own forecast
44.4		No entitlement will be there if Employer's interests are affected for not giving early warning by the contractor or not cooperating with the Engineer for evaluation
45	Change in law	The Engineer shall adjust the contract price for any change in law during the period 28 days prior to closing

		of bids and issue of completion certificate affecting, tax, duties and other levies
47	Price adjustment	The weightings for each of the inputs given in this clause, if in the opinion of the Engineer they have rendered unreasonable, unbalanced or inapplicable, input percentages as a result of variations or additional works, shall be adjusted
48.2	Retention	The second half of the retention shall be repaid when the defects liability period has passed and the Engineer certified all defects notified are corrected
49.2	Liquidated damages	If intended completion date is extended after LD is deducted the Engineer shall correct any over payment of LD in the next payment certificate, including interest payment as per sub clause 43.1
51.2	Advance payment	The contractor shall supply copies of documents to show how advance had been used to the Engineer
53.1	Day works	If applicable, the day works rates in the BOQ shall be used for small additional works, only

		when the Engineer has given written instructions for such work only
53.2		Day works should be recorded in forms approved by the Engineer. Each completed form shall be verified and signed by the Engineer within 2 days of work being done
53.3		The contractor shall be paid for day works subject to obtaining signed day works forms
55	Completion	The Engineer shall issue the certificate of completion on request by the contractor if the Engineer decides so. Similarly Final certificate shall be issued after all defects are corrected and the defects liability period is over.
57.1	Statement at completion	Within 21 days of issuing the completion certificate the contractor should submit the statement at completion, giving all that he considers due to him. The Engineer shall check and certify within 42 days. If not within 14 days of receipt of the SAC the Engineer shall issue a schedule indicating corrections and additions that are

		necessary. If still unsatisfactory, the Engineer shall decide amount payable.
57.2		After correction of all defects within 7 days the contractor shall submit the final payment request. The Engineer shall certify due payments within 42 days. If not, the Engineer shall issue within 14 days a schedule giving corrections and additions. If still unsatisfactory the Engineer shall decide the amount to be paid within 35 days.
58.2	Operation & maintenance manual	If the contractor does not supply the drawings/manuals by the specified date or the Engineer's approval is not received, the Engineer shall withhold the amount stated in the contract.
59.2	Termination	Fundamental breach of contract shall include but not limited to, (a) the Contractor stops work for 28 days and the stoppage is not authorized by the Engineer
59.3		When either party to the contract gives notice of a breach of contract, other than under sub clause 59.2 the Engineer shall

		decide whether the breach is fundamental or not.
60.1	Payment upon termination	<p>If the contract is terminated due to breach of contract, the Engineer shall issue a certificate for the value of work done and materials ordered, less advance payment remaining to be recovered up to the date of the issue of certificate and a percentage for part done work. Additional LD shall not apply.</p> <p>If the total amount due to the employer exceeds payment due to the contractor the difference shall be a debt payable to the employer</p>
60.2		<p>If the contract is terminated for Employer's convenience or breach of contract by the employer, the Engineer shall issue a certificate for the value of work done and materials ordered, reasonable cost for removal of equipment, repatriation of the contractor's personnel employed solely on the works, contractor's cost of protecting works and less advance payment remaining to</p>



		<p>be recovered up to the date of the issue of certificate and a percentage for part done work.</p> <p>The contractor shall be entitled for loss of profit or other damages caused by the termination</p>
62	Release from performance	<p>If the contract is frustrated by the outbreak of war or by any other event entirely outside the control of the employer or the contractor, the Engineer shall certify that the contract has been frustrated.</p>
63.2	Provisional sums and nominated subcontracting	<p>For each provisional sum the Engineer may instruct,</p> <p>a) work to be executed [including plant material or services to be supplied] by the contractor valued under sub clause 40</p> <p>b) plant material or services to be purchased by the contractor from a nominated sub-contractor as defined under sub clause 63.4</p>
63.3		<p>Payments under provisional sum shall be only those executed as instructed by the Engineer</p>
63.4		<p>The Engineer may nominate a</p>

		subcontractor as nominated sub-contractor under clause 39
63.5		The contractor shall not be under obligation to employ the engineer nominated sub-contractor if the contractor has reasonable objections, with supporting documents
63.6		The contractor shall pay to the nominated sub-contractor the amounts the Engineer certifies to be due, in accordance with the sub contract
63.7		The contractor is entitled for 8% percent of the amount certified by the Engineer
64.1	Suspension of works	The Engineer may at any time instruct the contractor to suspend progress of part or all of the works. During the period the contractor shall protect works and to secure from loss or damage
64.2		The Engineer may also notify the cause of suspension. If and to the extent that the cause is notified and is the responsibility of the contractor, sub clause 64.2, 64.3 and 64.4 shall not apply

64.3		The contractor shall be entitled for payment if, a) the work on plant, or delivery of plant and /or materials has been suspended for more than 28 Days and b) the contractor has marked the plant and /or materials as the employer's property in accordance with the Engineer's instruction
64.4		If the suspension under sub clause 64.1 has continued for more than 84 days, the contractor may request the Engineer's permission to proceed. If the Engineer does not give permission within 28 days after the request, the contractor may by giving notice to the Engineer, treat the suspension as an omission under clause 39 of the affected part of work. If the suspension affects the whole works, the contractor may give notice of termination under clause 59
64.5		After the permission or instruction to proceed is given, the contractor and the Engineer shall jointly examine the works and the plant and materials affected by the suspension. The

		contractor shall make good any deterioration
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TABLE 2

FIDIC –MDB version [1999]			SBD 02 [2007]		
Sub clause No.	Sub clause Title	Engineer's involvement	Sub clause No.	Sub clause Title	Engineer's involvement
1.3	Communication	Approvals certificates, consents and determinations, shall not be unreasonably withheld or delayed. Engineer to receive a copy of a notice issued by a party.	1.3	Communication	Engineer to receive a copy of a notice issued by a party Approvals certificates, consents and determinations, shall not be unreasonably withheld or delayed by the Engineer
1.5	Priority of documents	Listed as a) to h) The Engineer has to issue any clarification or instruction if there is any ambiguity or discrepancy in the set of documents	1.5	Priority of documents	Listed as a) to i); The Engineer shall issue any necessary clarification or instruction, if there is any ambiguity or discrepancy in the set of documents
1.8	Care and supply of documents	The Engineer is to receive six or stipulated number of copies of each of contractor's documents	1.8	Care and supply of documents	The Engineer is to receive six or stipulated number of copies of each of contractor's documents
1.9	Delayed drawings / instruction	If necessary drawings are not issued, the Engineer will receive notice from the contractor on likely delay or disruption. If further delay caused cost to the contractor, he is entitled for extra payment as per sub	1.9	Delayed drawings or instructions	If necessary, drawings or instructions are not issued the Engineer will receive notice from the contractor on likely delay or disruption If further delay caused cost to the contractor, he is entitled for extra payment as per sub clause 19.1 and time as per sub clause 8.4 Engineer shall determine under 3.4

		clause 20.1 and time as per sub clause 8.4. The Engineer shall determine on such claim. If the failure is by reasons of the contractor, there is no entitlement	1.12	Confidential details	The Engineer can verify the contractor's documents and information, for compliance with the contract
1.12	Confidential details	The Engineer can verify the contractor's documents and information confidential or other, for compliance with the contract	2.1	Right of access to the site	The Engineer will receive contractor's notice to claim under sub clause 19.1 for time and cost. The Engineer has to determine these, in case contractor suffers delay due to access to the site. If the failure is by reasons of the contractor there is no entitlement
2.1	Right of access to the site	The Engineer will receive contractor's notice to claim under sub clause 20.1 for time and cost. The Engineer on receipt of a notice, has to determine as per sub clause 3.5. If the failure is by reasons of the contractor there is no entitlement			
2.5	Employer's claims	The Engineer will receive Employer's notice to claim under this sub clause for cost, or extension of defects notification period. No notice is required for payments due under sub clauses 4.19 [ <i>electricity water and gas</i> ] and 4.20 [ <i>employer's equipment and free issue materials</i> ] The Engineer has to determine under sub	2.4	Employer's claims	The Engineer will receive Employer's notice to claim under this sub clause for cost or extension of defects notification period. The Engineer has under 3.4 to agree or determine (i) the amount which the employer is entitled to be paid by the contractor (ii) extension of the defects notification period as per sub clause 11.3 The amount may be included as a deduction in

		<p>clause 3.5 [determination] The amount may be included as a deduction in contract price and adjust payment certificates accordingly</p>			<p>contract price and adjust payment certificates accordingly</p>
3.1	Engineer's duties and responsibilities	<p>The Engineer</p> <ul style="list-style-type: none"> <li>- Shall carry out the duties assigned in the contract</li> <li>- shall have no authority to amend the contract.</li> <li>- may exercise authority attributable as specified in the contract and implied from the contract</li> <li>- shall obtain approval from Employer for <u>matters stated in particular conditions</u></li> <li>- will not be imposed any constraints on Engineer's authority except as agreed with the contactor.</li> <li>- be deemed to act for the employer in carrying out duties and exercising authority</li> <li>-has no authority to relieve either party of any duties, obligations or responsibilities under the contract.</li> <li>has no authority to relieve either party of any duties, obligations or</li> <li>- is not relieving the contractor of his responsibilities or</li> </ul>	3.1	Engineer's duties and responsibilities	<p>The Engineer,</p> <ul style="list-style-type: none"> <li>- Shall carry out the duties assigned in the contract</li> <li>- has no authority to amend the contract</li> <li>- may exercise authority attributable as specified in the contract and implied from the contract</li> <li>- Approval should be obtained from Employer for <u>matters stated in contract data only</u></li> <li>- will not be imposed any constraint other than those listed in the contact</li> <li>- has no authority to relieve either party of any duties, obligations or responsibilities under the contract.</li> <li>- is not relieving the contractor of contractor's responsibilities or obligations by his approvals, checks, certificates, consent, examination, inspection, notice, proposal, test or any similar act.</li> </ul>

		obligations by his approvals [including absence of disapprovals], checks, certificates, consent, examination, inspection, notice, proposal, test or any similar act, including responsibility for errors, omissions, discrepancies and non-compliance.			
3.2	Delegations by the Engineer	<p>The Engineer,</p> <ul style="list-style-type: none"> <li>- may delegate his authority to assistants from time to time</li> <li>- Assign different assistants in writing</li> <li>- may revoke delegations and assigning in writing with copies to the parties</li> <li>- Shall not delegate authority of determination under sub clause 3.5</li> <li>- has right to reject any work, plant or material and the assistants too to the level of delegation done</li> <li>- failure to disapprove shall not constitute approval and shall not prejudice the Engineer's right to reject</li> <li>- shall promptly confirm, reverse or vary any decision given by</li> </ul>	3.2	Delegations by the Engineer	<p>The Engineer,</p> <ul style="list-style-type: none"> <li>- may delegate his authority to assistants from time to time</li> <li>- Assign different assistants in writing</li> <li>- may revoke delegations and assigning in writing</li> <li>- Shall not delegate authority of determination under sub clause 3.4</li> <li>- has right to reject any work, plant or material, despite failure to disapprove</li> <li>- shall promptly confirm, reverse or vary any decision given by an assistant</li> <li>- failure to disapprove shall not constitute approval and shall not prejudice the Engineer's right to reject</li> <li>- shall promptly confirm, reverse or vary any decision given by an assistant if the contractor questions</li> </ul>

		an assistant if the contractor questions			
3.3	Instructions of the Engineer	<p>The Engineer may issue to the contractor at any time in writing,</p> <ul style="list-style-type: none"> <li>- necessary instructions and additional or modified drawings necessary for execution of work,</li> <li>Or remedy any defect,</li> <li>- even for a variation under clause 13</li> </ul> <p>Whenever possible the instructions should be in writing.</p> <p>If the Engineer or assistant</p> <ul style="list-style-type: none"> <li>a) gives an oral instruction</li> <li>b) receives a written confirmation from the contractor within two working days after giving the instruction and</li> <li>c) does not reply by issuing a written rejection and /or instruction within two working days, then the confirmation shall constitute the written instruction of the Engineer or the assistant</li> </ul>	3.3	Instructions of the Engineer	<p>The Engineer may issue to the contractor at any time in writing,</p> <ul style="list-style-type: none"> <li>- necessary instructions for execution of work,</li> <li>- remedy any defect,</li> <li>- even for a variation under clause 13</li> </ul>
3.5	Determination	<p>The Engineer shall,</p> <ul style="list-style-type: none"> <li>- Consult each party to agree</li> <li>- Determine if not possible to agree</li> </ul>	3.4	Determination	<p>The Engineer shall,</p> <ul style="list-style-type: none"> <li>- Consult each party to agree</li> <li>- Determine if not possible</li> </ul>



		<p>- Give notice to both parties of each agreement or determination</p> <p>Parties may follow clause 20 claims, disputes and arbitration if not agreed</p>			<p>- Give notice to both parties of each agreement or determination</p> <p>Parties may follow clause 19 claims, disputes and arbitration if not agreed</p>
			3.5	Engineer's impartiality	<p>Engineer is expected to exercise discretion,</p> <ul style="list-style-type: none"> <li>- In giving decision, opinion or consent</li> <li>- expressing satisfaction or approval</li> <li>- determining values</li> <li>- taking action which may affect rights and obligations of either party</li> </ul> <p>The parties have freedom for review or revision under clause 19</p>
4.1	Contractor's general obligations	<p>-The Engineer's instructions should be followed</p> <p>-Details required by the Engineer should be submitted</p> <p>- Engineer should be given alterations of methods or arrangements informed or agreed earlier</p> <p>- If the contract defines the contractor shall design any part of the permanent works the Engineer is involved in sub clause requirements a) to d)</p>	4.1	Contractor's general obligations	<p>-The Engineer's instructions should be followed</p> <p>-Details required by the Engineer should be submitted</p> <p>- Engineer should be given alterations of methods or arrangements informed or agreed earlier</p> <p>- If the contract defines the contractor shall design any part of the permanent works the Engineer is involved in sub clause requirements a) to d)</p>
4.2	Performance security	<p>The Engineer has to Receive a copy of performance security.</p>	4.2	Performance security	<p>The Engineer has to make written request to the contractor to increase the Value of performance security if the original</p>

					contract price is increased, as determined by the Engineer as a result of a change in cost and /or change of law and /or as result of variations.
4.3	Contractor's representative [CR]	<p>The Engineer has to consent the appointment of the CR unless the person has been nominated in the contract</p> <p>If the consent for CR is revoked by the Engineer replacement also shall be with the Engineer's consent.</p> <p>Temporary absence of CR from site too, shall be with the Engineer's consent</p> <p>Also, the Engineer has to consent if the CR is to be removed by the contractor</p> <p>If the CR delegates any powers and functions to any competent person or revoke such delegation both shall not take effect without given written notice to the Engineer</p>	4.3	Contractor's representative [CR]	<p>The Engineer has to consent the appointment of the CR unless the person has been nominated in the contract</p> <p>Also, the Engineer has to consent if the CR is to be removed by the contractor</p> <p>Engineer shall give instructions to CR under sub clause 3.3</p>
4.4	Subcontractors	<p>Unless named in the contract, the Engineer has to consent the engagement of subcontractors</p> <p>The Engineer should have 28 days for consent for commencement of work by each subcontractor</p>	4.4	Subcontractors	<p>The Engineer has to consent the engagement of subcontractors.</p> <p>The Engineer should have 28 days for consent for commencement of work by each subcontractor</p>

4.5	Assignment of benefit of sub contracts	The Engineer has to instruct the contractor on needs if the subcontractors' obligations extend beyond the expiry date of the Defects Notification Period.	4.5	Assignment of benefit of sub contracts	The Engineer has to instruct the contractor on needs if the subcontractors' obligations extend beyond the expiry date of the Defects Notification Period
4.6	Co operation	The Engineer can instruct the contractor to allow appropriate opportunities for carrying out works by others – Employer, other contractor, public authority personnel. The contractor shall give to Engineer such documents in the time and manner stated in specification, if under the contract the employer is required to give to the contractor on foundation structure plant or means of accesses	4.6	Co operation	The Engineer can instruct the contractor to allow appropriate opportunities for carrying out works by others – Employer, other contractor, public authority personnel. Any such instruction shall be a variation, if the contractor has to incur unforeseeable cost
4.7	Setting out	The Engineer may notify the contractor on setting out in addition to those specified in contract, if required. The Engineer will be notified by the contractor claiming delay or/and cost, if errors are found in reference points given the document by the Employer for setting out. On receipt of the notice the Engineer shall	4.7	Setting out	The Engineer shall receive notification of setting out from the contractor. The Engineer will be notified by the contractor if errors are found in reference points given in the document by the Employer for setting out, for time and cost. On receipt of the notice the Engineer shall determine the matter

		determine the matter as relevant			
4.9	Quality assurance	<p>The Engineer shall be entitled to audit any aspect of the QA system submitted by the contractor with details of all particulars and compliance.</p> <p>When details of any document of technical nature, is issued to the Engineer, evidence of prior approval by the contractor shall be apparent in the document.</p>	4.11	Unforeseeable physical conditions	<p>The Engineer will receive notice from contractor on such unforeseeable conditions.</p> <p>The Engineer has to inspect and give necessary instructions and make determinations as required.</p> <p>Before additional cost is agreed or determined, the Engineer may also review whether other physical conditions in similar parts of the works [if any] were more favorable than could reasonably have been foreseen when the contractor submitted the tender</p>
4.12	Unforeseeable physical conditions	<p>The Engineer will receive notice under sub clause 20.1, from contractor on such unforeseeable conditions</p> <p>The Engineer has to inspect and give necessary instructions and make determinations as required depending on the claim submitted under the relevant clauses</p> <p>Before additional cost is agreed or determined, the Engineer may also review whether other physical conditions in similar parts of the works [if any] were</p>	4.12	Contractor's equipment	<p>The Engineer's consent is required for the contractor to move any equipment out of site</p>

		more favorable than could reasonably have been foreseen when the contractor submitted the tender. Any variation involved shall be under clause 13. If and to the extent that these more favorable conditions were encountered, the Engineer may proceed according to sub clause 3.5 [ <i>determination</i> ] to agree or determine the reduction in cost which may be included in contract price and in payment certificates.			
4.16	Transport of goods	Unless otherwise stated in PCC, the contractor shall give notice to the Engineer not less than 21 days' notice of date on which any plant or major items of other goods will be delivered to site.	4.14	Progress reports	The Engineer shall receive monthly progress reports from the contractor within 7th day of the next month. The Engineer has to see the completeness of the report as in (a) to (h) of the clause.
4.17	Contractor's equipment	The contractor shall not remove from site any major item of contractor's equipment without the consent of the Engineer except for transport vehicles of persons and goods	4.15	Contractor's operations on site	The Engineer has to agree with the areas of operations. The Engineer has to ensure the contractor's operations are as described in the clause
4.19	Electricity water and gas	The quantities consumed and the amounts due [at these prices] for such services shall be agreed and determined by the Engineer in accordance with the sub clauses 2.5	4.16	Fossils	The Engineer shall issue instructions to the contractor on receiving notice of finding fossils at site, make required determinations for matters arising out of the situation such as,

		[ <i>employer's claim</i> ] and 3.5 [ <i>determination</i> ]			protection of the items, informing relevant authorities, EOT etc. The Contractor shall give further notice to the Engineer under sub clause 19.1 for time and cost if his work is affected. Engineer shall determine cost and time under sub clause 3.4 as relevant.
4.20	Employer's equipment and free-issue materials	Appropriate quantities and the amounts due [at such stated price] for the use of the employer's equipment shall be agreed and determined by the Engineer in accordance with the sub clauses 2.5 [ <i>employer's claim</i> ] and 3.5 [ <i>determination</i> ]	4.17	Quality Assurance	The Engineer has to ensure QA procedures are agreed and followed by the contractor from inception to end
4.21	Progress reports	The Engineer shall receive monthly progress reports from the contractor within 7th day of the next month in six copies. <i>[The Engineer has to see the completeness of the report as in (a) to (h) of the clause]</i>	4.21	Transport of goods	The Engineer has to be informed 7 days before, by the contractor of any major plant or goods is to be delivered to site
4.22	Security of the site	The Engineer has to inform the contractor, the other personnel to enter the site except contractor's and employer's personnel	4.22	Security of the site	The Engineer has to inform the contractor the other personnel to enter the site except contractor's and Employer's personnel
4.23	Contractor's operations at site	Any additional areas outside site boundaries shall be agreed by the Engineer if the	5.1	Nominated subcontractor	The Engineer can instruct to employ a nominated subcontractor under clause 13[ <i>variations &amp; adjustments</i> ].

		contractor needs such space			
4.24	Fossils	The contractor shall give notice to the Engineer upon discovery of any such fossil AND the Engineer shall issue instructions for dealing with it. If the contractor considers to suffer delay or cost, clause 20 has to be followed for them	5.2	Objection to nomination	The Engineer has to resolve with the Employer; if the contractor makes a reasonable objection with documentary proof
5.1	Nominated subcontractor	The Engineer can instruct to employ a nominated subcontractor under clause 13.	5.3	Payment to nominated subcontractor	The Engineer has to certify payments for nominated subcontractor [separately in the same IPA]
5.2	Objection to nomination	The Engineer has to resolve with the Employer, if the contractor makes a reasonable objection with documentary proof for nominated subcontractor	5.4	Evidence of payment	The Engineer can request the contractor to submit proof of payments to nominated subcontractor If not, can withhold or refuse to make payment, unless the contractor shows reasons, not to pay the nominated subcontractor.
5.3	Payment to nominated subcontractor	The Engineer has to certify payments for nominated subcontractor [separately in the same IPA]	6.4	Working hours	The Engineer can give consent to work extended hours. Allow work when unavoidable and in necessary situations to protect work.
5.4	Evidence of payment	The Engineer can request the contractor to submit proof of payments to nominated subcontractor If not, can withhold or refuse to make	6.6	Health and safety	Engineer should receive accident reports. The Engineer may require records and reports regarding health, safety and welfare of persons and accidents.

		payment, unless the contractor shows reasons not to pay the nominated subcontractor			
6.5	Working hours	The Engineer can give consent to work extended hours. Allow work when unavoidable and in necessary situation to protect work	6.8	Contractor's personnel	The Engineer may request to remove the contractor's personnel if so required, with reasons on 4 counts listed in the clause.
6.7	Health and safety	Engineer should receive accident reports. The Engineer may require records and reports regarding health, safety and welfare of persons and accidents	6.9	Records of contractor's personnel and equipment	The Engineer should be given details by the contractor, each calendar month until the work is completed, in a format approved by the Engineer.
6.9	Contractor's personnel	The Engineer may request to remove the contractor's personnel if so required, under 4 counts listed under the clause	7.1	Samples	The Engineer should get material samples from the contractor for consent to use at works. Additional samples instructed by the Engineer is a variation.
6.10	Records of contractor's personnel and equipment	The Engineer should be given details by the contractor, each calendar month until the work is completed, in a form approved by the Engineer	7.2	inspection	The Engineer will be notified by the contractor when any work is ready. The Engineer has to inspect or inform no need to inspect without delay and accept or reject to proceed after inspection. Any work done without informing can be made to uncover and then reinstate at contractor's cost.
7.2	Samples	The Engineer should get samples from the	7.3	Testing	The Engineer Shall be informed the time, place for the testing



		<p>contractor for consent to use at works.</p> <p>Engineer may ask for additional samples and will be under a variation payment.</p>			<p>of plant, materials and any part of work.</p> <p>The Engineer may change location or details of specified tests or instruct additional tests.</p> <p>The Engineer shall give not less than 24 hours' notice of the Engineer's intention to attend the test.</p> <p>If the Engineer fails to attend in time at the place agreed the contractor can proceed with the test.</p> <p>If the contractor suffers cost or delay due to these instructions, he has right to claim under clause 19, for cost and time.</p> <p>The Engineer then has to determine under clause 3.4.</p> <p>The Engineer has to endorse the test reports submitted by the contractor immediately after.</p> <p>If the Engineer fails to act the tests will be considered as accepted by the Engineer</p>
7.3	Inspection	<p>The Engineer shall be notified by the contractor when any work is ready.</p> <p>The Engineer has to inspect or inform no need to inspect without delay and accept or reject or to proceed after inspection.</p>	7.4	Rejection	<p>The Engineer may reject any work, material or plant with reasons.</p> <p>The contractor shall correct on receipt of Engineer's notice;</p> <p>If the Engineer requests a test has to be repeated.</p> <p>If the Employer incurred cost due to these, payment can be made to</p>

		<p>Any work done without informing can be made to uncover and then reinstate at contractor's cost.</p> <p>The contractor shall give notice to the Engineer when any work is ready, before covered up, put out of sight.</p> <p>If not, Engineer has authority to instruct the contractor to uncover at his cost.</p>			the Employer under sub clause 2.4 [Employer's claim]
7.4	Testing	<p>The Engineer, Shall be informed the time, place for the testing of plant, materials and any part of work.</p> <p>The Engineer may change location or details of specified tests or instruct additional tests.</p> <p>The Engineer shall be given not less than 24 hours' notice of the Engineer's intention to attend the test.</p> <p>If the Engineer fails to attend in time at the place agreed the contractor can proceed with the test.</p> <p>If the contractor suffers cost or delay due to these instructions, he has right to claim under clause 20, for cost and time.</p> <p>The Engineer then has to determine under clause 3.5.</p>	7.5	Remedial work	<p>The Engineer may instruct the contractor,</p> <p>To remove and replace materials or plant.</p> <p>To remove and re-execute works not in accordance with the contract requirements,</p> <p>To execute any work urgently required, by engaging others if the contractor fails.</p> <p>If the Employer incurred cost due to these, payment can be made to the employer under sub clause 2.4 [Employer's claim]</p>

		<p>The Engineer has to endorse the test reports submitted by the contractor immediately after.</p> <p>If the Engineer fails to act, the tests will be considered as accepted by the Engineer</p>			
7.5	Rejection	<p>The Engineer may reject any work, material or plant with reasons. The contractor shall correct on receipt of Engineer's notice. If the Engineer requests, a test has to be repeated. If the Employer incurred cost due to these, payment can be made to the employer under sub clause 2.5 [Employer's claim]</p>	8.1	Commencement of works	<p>The Engineer shall give the contractor not less than 7 days' notice of commencement date, unless otherwise given in contract data; Start shall be within 14 days after the contractor receiving the letter of acceptance</p>
7.6	Remedial work	<p>The Engineer may instruct the contractor to; Remove and replace materials or plant. remove and re-execute works not in accordance with the contract requirements, execute any work urgently required If the Employer incurred cost due to these, payment can be made to the employer under sub clause 2.5 [Employer's claim]</p>	8.3	Program	<p>The Engineer has to receive a program within 14 days of commencement notice under above 8.1, and a revised program when the program in use is inconsistent with progress. The Engineer has to inform the contractor, if it does not comply with the contract within 14 days of receipt. The Engineer may require the contractor to submit a revised program, if a</p>

					probable delay event is noticed by the contractor. The Engineer can request a revised program if the current program is inconsistent with progress.
8.1	Commencement of works	The Engineer shall give the contractor not less than 7 days' notice of commencement date unless otherwise given in particular conditions; Shall be within 42days after the contractor receiving the letter of acceptance.	8.4	Extension of time [EOT] for completion	The Engineer has to receive, notice for EOT under 19.1; review and determine the contractor's claim for EOT considering (a) to (e) of this clause
8.3	Program	The Engineer has to receive a program within 28 days of commencement notice, and a revised program when the program in use is inconsistent with progress. Each program shall include items (a) to (d) in the clause. The Engineer may inform the contractor if it does not comply with the contract within 21 days of receipt. If not, the program will be considered accepted. The Engineer may be informed by the contractor if a probable event is noticed for delay by the contractor. The Engineer may request a revised program for a probable delay or if the current	8.6	Rate of progress	The Engineer may instruct to, revise methods for improving rate of progress and review and inform the contractor to complete within time.

		program is inconsistent with progress, then the contractor shall provide the same			
8.4	Extension of time [EOT] for completion	The Engineer has to receive, review and determine the contractor's claim for EOT. Causes for extension are given in (a) to (e) in the contract clause The Engineer shall review previous extensions when determining each extension	8.8	Suspension of work	The Engineer may suspend work notifying the reasons to the contractor. If the cause is contractor's responsibility, he is not entitled for sub clauses 8.9, 8.10 and 8.11
8.6	Rate of progress	The Engineer may, if the rate of progress is low, instruct to, submit a revised program and revised methods to expedite progress and review and inform the contractor. If these methods incur additional costs to the Employer, claims in addition to delay damages [sub clause 8.7] may be made under 2.5 [employer's claim] which has to be determined by the Engineer	8.9	Consequence of suspension	The Engineer has to receive, review and determine the contractor's claims on suspension
8.8	Suspension of work	The Engineer may suspend work notifying the reasons to the contractor. If the reasons are due to contractor sub clauses 8.9 to 8.11 shall not apply	8.11	Prolonged suspension	If the Engineer does not allow work within 28 days after the request [made after 84 days of suspension], to re-start work the contractor has right to consider the work

					as omission [see 8.8] under clause 13 If the suspension affected all of the works, contractor can give notice of termination under sub clause 16.2
8.9	Consequence of suspension	The Engineer has to receive, review and determine the contractor's claims on suspension	8.12	Resumption of work	The Engineer and contractor shall examine jointly the works and plant and material affected by suspension, after the permission by the Engineer to proceed
8.11	Prolonged suspension	If the Engineer does not permit work within 28 days after the request [made after 84 days of suspension], to start work the contractor has right to consider the work as omission [see 8.10] If the suspension affected all of the works contractor can give notice of termination	8.13	Management meeting	The Engineer or the contractor may call for management meetings to review the arrangements for future works. The Engineer shall record and send copies of the record to parties who attended and the Employer.
8.12	Resumption of work	The Engineer and contractor shall examine jointly the works and plant and material affected by suspension after permission by the Engineer to proceed	9.1	Contractor's obligations	The Engineer shall receive from the contractor; - not less than 21 days 'notice before each of the test. -Tests on completion will be carried out within 14 days of instruction to test, is received. -The test certificates shall be given as soon as possible. The Engineer shall inform the Employer possible time of use of the works considering the allowances for any effect

					based on these certificates.
9.1	TESTS ON COMPLETION Contractor's obligations	The Engineer shall receive from the contractor, Not less than 21 days' notice for each test to do. Tests on completion will be carried out within 14 days after the instruction to test is received. The test certificates shall be given as soon as possible. The Engineer shall inform the Employer possible time of use of the works considering the allowances for any effect based on these certificates.	9.2	Delayed tests	The Engineer may notice the contractor to carry out completion tests within 21 days if the tests are unduly delayed.
9.2	Delayed tests	The Engineer may notice the contractor to carry out completion tests within 21 days if the tests are unduly delayed	9.3	Retesting	The Engineer or the contractor may request to repeat a failed test under the same terms and conditions
9.3	Retesting	The Engineer or the contractor may request to repeat a failed test under the same terms and conditions	9.4	Failure to pass tests on completion	If tests on completion repeatedly fail and a section or the works cannot be accepted, the Engineer is entitled to order, retesting or reject the works or the section leading to an Employer's claim and/or issue the taking over certificate if the employer requests under sub clause 2.4
9.4	Failure to pass tests on completion	a) If tests on completion repeatedly fail and a section or the works	10.1	Taking over of the works /sections	The Engineer may receive notice to take over, from the contractor not earlier

		cannot be accepted the Engineer is entitled to order, retesting or reject the works or the section leading to an Employer's claim and/or issue the taking over certificate if the employer requests			than 14 days before the work will be complete. The Engineer shall within 28 days after receiving the notice, - issue the taking over certificate with a defects list, - reject application giving reasons; - If the works are completed within 28 days, issue the taking over certificate as to the requested date, as appropriate; -If the Engineer fails to issue or reject the taking over certificate within 28 days of request and the work is substantially complete work or the section of it is deemed to be taken over and he certificate issued;
10.1	Taking over of the works /sections	The Engineer may receive notice to take over, from the contractor not earlier than 14 days before the work will be complete. The Engineer shall within 28 days after receiving the notice, - issue the taking over certificate stating the date the works /section was over except for minor outstanding works and defects list - reject application giving reasons - If the works are completed issue the	10.2	Taking over of parts of the works	The Engineer may at the discretion of the Employer issue the taking over certificate for a section of works. Until the Engineer issues the taking over certificate, the Employer shall not use any section or part of the works. Any part if used will be considered as taken over. The Engineer shall issue taking over certificate if the contractor requests so. Then the contractor shall take any outstanding tests on completion.



		<p>taking over certificate on which date work /section is completed except for minor outstanding work, which will not substantially affect the use, as appropriate.</p> <p><b>If the Engineer fails to issue the taking over certificate or to reject the contractor's application within 28 days &amp; if the works or section is substantially completed taking over shall deemed to be issued</b></p>			<p>The Engineer may receive a cost claim from the contractor as per sub clause 19.1 and in such an event and shall determine.</p> <p>If a section is taken over, the liquidated damages if applicable will be reduced proportionately by the Engineer, under determination.</p>
10.2	Taking over of parts of the works	<p>The Engineer may at the discretion of the Employer issue the taking over certificate for a section of works Until the Engineer issues the taking over certificate the Employer shall not use any section or part of the works Any part if used will be considered as taken over.</p> <p>The Engineer shall issue taking over certificate if the contractor requests so for the part.</p> <p>Then the contractor shall take any outstanding tests on completion.</p> <p>The Engineer may receive a cost claim from the contractor and in such an event of employer using before</p>	10.3	Interference with tests on completion	<p>The Engineer shall issue the taking over certificate on due date, deducting the 14 days, if tests on completion are delayed by more than 14 days, due to a reason by the Employer.</p> <p>The Engineer shall give notice to the contractor to carry out the delayed tests as soon as possible within 14 days</p> <p>The Engineer may receive a claim notice form the contractor in such a situation and the Engineer may allow time and cost as appropriate under the relevant clauses.</p>

		<p>taking over and shall determine such cost &amp; profit.</p> <p>If a section is taken over, the liquidated damages if applicable will be reduced proportionately by the Engineer, under determination</p>			
10.3	Interference with tests on completion	<p>The Engineer shall issue the taking over certificate on due date deducting the 14 days, if tests on completion are delayed by more than 14 days, due to a reason by the Employer.</p> <p>The Engineer shall give notice to the contractor to carry out the delayed tests as soon as possible within 14 days</p> <p>The Engineer may receive a claim notice from the contractor for cost and time in such a situation and the Engineer may determine the matters.</p>	11.1	Completion of outstanding works and remedying defects	<p>The Engineer shall specify a reasonable time to the contractor to complete before the end of DNP. Any defect or damage seen should be notified to the contractor</p>
			11.4	Failure to remedy defects	<p>If the contractor fails to remedy defect or damage by the notified date, the Engineer has to agree or determine a reasonable reduction in contract price</p>
11.1	Completion of outstanding works and remedying defects	<p>The Engineer shall specify a reasonable time to the contractor to complete before the end of DNP</p> <p>Any outstanding work and defect seen should be notified to the contractor</p>	11.6	Further tests	<p>If the remedying of a defect or damage has an effect on the performance of the works the Engineer may require repetition of any test described in the contract by a notice within 28 days.</p>
11.4	Failure to remedy defects	<p>If the contractor fails to remedy defect or damage by the notified date, the Engineer has</p>	11.7	Contractor to search	<p>The Engineer may require the contractor to search for the cause of any defect.</p>

		to agree or determine a reasonable reduction in contract price			If the defects are not to be corrected at the cost of the contractor the cost of search + profit and overhead is also to be paid to the contractor as agreed or determined by the Engineer
11.6	Further tests	If the remedying of a defect or damage has an effect on the performance of the works, the Engineer may require repetition of any test described in the contract by a notice within 28 days.	11.8	Performance certificate	The Engineer shall issue the performance certificate stating the date on which the contractor completed his obligations under the contract. It should be issued within 28 days of the end of DNP OR when the contractor has supplied the documents, and tested all work including defect corrections
11.8	Contractor to search	The Engineer may require the contractor to search for the cause of any defect. If the defect is not to be corrected at the cost of the contractor the cost of search + profit and overhead is also to be paid to the contractor as determined or agreed by the Engineer	12.1	Works to be measured	The works shall be measured and valued by the Engineer or representative. The Engineer may require any particulars from the contractor. The measurements are to be agreed with the contractor. If the contractor gives notice of disagreement the Engineer shall review records and either confirm or vary the measurements. If such notice is not received by the Engineer within 14 days the Engineer's valuation is considered accepted
11.9	Performance certificate	The Engineer shall issue the performance	12.3	Evaluation	The Engineer shall agree or determine the contract

		<p>certificate stating the date on which the contractor completed his obligations under the contract, with a copy to the Employer.</p> <p>It should be issued within 28 days of the end of DNP</p> <p>OR, when the contractor has supplied the documents, and tested all work including defect corrections</p>			<p>price by evaluating each item of work applying the measurements agreed or determined under sub clause 12.1 and 12.2</p> <p>A new rate shall be appropriate for an item if,</p> <p>a) i. Quantity changed by more than 25% in BOQ</p> <p>ii. The change in item price exceeds 0.01% of contract price</p> <p>OR</p> <p>b) i. work instructed under clause 13.</p> <p>ii. no rate is specified in the contract in BOQ</p> <p>iii. No rate is appropriate, as the item is not similar or not executed under similar conditions</p> <p>New rate shall be derived from any relevant rate in the contract with reasonable adjustment as in a) and b) above.</p> <p>If not, a new reasonable rate has to be derived</p> <p>Until a rate is agreed the Engineer shall determine a provisional rate.</p>
12.1	Works to be measured	<p>The works shall be measured and valued by the Engineer.</p> <p>The Engineer may require any particulars from the contractor.</p> <p>The measurements are to be agreed with the contractor. If the contractor gives notice</p>	12.4	Omission	<p>Whenever the omission of any work forms a part of a variation, the Engineer may receive a notice from the contractor if,</p> <p>(a) The contractor will incur cost which deemed to be covered in the contract price</p>

		<p>of disagreement the Engineer shall review records and either confirm or vary the measurements.</p> <p>If such notice is not received by the Engineer within 14 days the Engineer's valuation is considered accepted</p>			<p>(b) The omission will result in this sum not forming part of the contract price</p> <p>(c) this cost is not deemed to be included in the evaluation of any substituted work</p> <p>The Engineer shall determine under sub clause 3.4</p>
12.3	Evaluation	<p>The Engineer shall agree or determine the contract price by evaluating each item of work applying the measurements agreed or determined under sub clause 12.1 and 12.2</p> <p>A new rate shall be appropriate for an item if,</p> <p>a) i. Quantity changed by more than 10% in BOQ</p> <p>ii. The change in item price exceeds 0.01% of contract price</p> <p>iii. Cost per unit is changed by more than 1% and this item is not specified as a fixed rate item</p> <p>OR</p> <p>b) i. work instructed under clause 13.</p> <p>ii. no rate is specified in the contract</p> <p>iii. No rate is applicable as the item is not similar or</p>	13.1	Right to vary	<p>The Engineer may initiate variations any time prior to issuing taking over certificate.</p> <p>This may be as an instruction or as a request for proposal by the contractor.</p> <p>The contractor may refuse to undertake giving reasons why the required goods cannot be readily obtained.</p> <p>The Engineer can vary or confirm or cancel the instruction.</p> <p>A variation may include six things as listed from (a) to (f) please refer the clause.</p> <p>Unless the Engineer instructs or approves a variation the contractor shall not make any alteration of permanent works.</p>

		<p>not executed under similar conditions</p> <p>New rate shall be derived from any relevant rate in the contract with reasonable adjustment as in a) and b) above. If not, a new reasonable rate has to be derived. Until a rate is agreed the Engineer shall determine a provisional rate.</p>			
12.4	Omission	<p>Whenever the omission of any work forms a part of a variation, The Engineer may receive a notice from the contractor if</p> <p>a) The contractor will incur cost which deemed to be covered in the contract price</p> <p>b) The omission will result in this sum not forming part of the contract price</p> <p>c) This cost is not deemed to be included in the evaluation of any substituted cost.</p> <p>The Engineer shall determine under sub clause 3.5 after receiving notice from the contractor</p>	13.2	Value Engineering	<p>The Engineer may receive a proposal from the contractor if in his opinion these are possible;</p> <p>i) accelerate completion</p> <p>ii) reduce cost to the Employer of executing, maintaining or operating the works,</p> <p>iii) improve the efficiency or value to the Employer,</p> <p>iv) Otherwise, be benefit to the Employer.</p> <p>The proposal shall be prepared at the contractor's cost and should be included in the list in the sub clause 13.3</p> <p>If the proposal is approved by the Engineer and needs change of design of permanent works [a part even], unless otherwise agreed what is to be done is listed under (a) (b) and (c). [please refer the clause]</p>
13.1	Right to vary	The Engineer may initiate variations any	13.3	Variation procedure	If the Engineer requires for a proposal the

		<p>time prior to issuing taking over certificate. This may be as an instruction or as a request for proposal by the contractor.</p> <p>The contractor may refuse to undertake giving reasons why the required goods cannot be readily obtained.</p> <p>The Engineer can vary or confirm or cancel the instruction.</p> <p>A variation may include six things as listed from (a) to (f) please refer the clause.</p> <p>Unless the Engineer instructs or approves a variation the contractor shall not make any alteration of permanent works</p>			<p>contractor shall as soon as practicable, in writing inform why he cannot undertake OR submit the following</p> <ul style="list-style-type: none"> <li>a) Description of work proposed with program</li> <li>b) Proposal for any modification to the overall construction program</li> <li>c) His cost proposal for the same</li> </ul> <p>The Engineer shall respond as soon as possible under sub clause 13 .2 or other.</p> <p>The contractor shall not delay any work till the Engineer responds.</p> <p>The Engineer shall inform the cost and the Contractor should acknowledge the receipt.</p> <p>The Engineer's evaluation shall be under clause 12.</p>
13.2	Value Engineering	<p>The Engineer may receive a proposal from the contractor if in his opinion these are possible,</p> <ul style="list-style-type: none"> <li>i) accelerate completion</li> <li>ii) reduce cost to the Employer of executing, maintaining or operating the works,</li> <li>iii) improve the efficiency or value to the Employer,</li> <li>iv) Otherwise, be benefit to the Employer.</li> </ul> <p>The proposal shall be prepared at the contractor's cost and</p>	13.4	Provisional sums	<p>The Engineer shall instruct separately to use each provisional sum in part or full and contract price should be adjusted accordingly.</p> <p>The payment shall include only such amounts for the works, supplies or services, related to the p. sum instructed by the Engineer.</p> <p>The Engineer may instruct (a) and (b) [please refer to the clause]</p> <p>The contractor shall produce quotations and</p>

		<p>should be included in the list in the sub clause 13.3</p> <p>If the proposal is approved by the Engineer and needs change of design of permanent works [a part even], unless otherwise agreed what is to be done is listed under a) b) and c). [please refer the clause]</p>			accounts etc. as required by the Engineer.
13.3	Variation procedure	<p>If the Engineer requests for a proposal the contractor shall as soon as practicable, in writing inform why he cannot undertake or submit the following</p> <ul style="list-style-type: none"> <li>a) Description of work proposed with program</li> <li>b) Proposal for any modification to the overall construction program</li> <li>c) His proposal for evaluation of the same</li> </ul> <p>The Engineer shall respond as soon as possible, with approval, disapproval or comments, under sub clause 13 .2 or other. The contractor shall not delay any work till the Engineer responds. The Engineer shall inform the cost and the Contractor should acknowledge the receipt.</p>	13.5	Day works	<p>The Engineer may instruct works of minor and incidental natures in a variation on day work schedule in the contract. If day works schedule is not in the contract this clause is not be applicable.</p> <p>Before ordering work, quotations should be obtained from the contractor.</p> <p>The contractor shall submit invoices etc. when applying for payments.</p> <p>For each day the contractor should submit in duplicate resources used exceeding the previous day' work</p> <ul style="list-style-type: none"> <li>a) name occupation hours of work for labor</li> <li>b) type time capacity and identification number for machines</li> <li>c) quantity and type etc. for materials</li> </ul> <p>Agreed records should be filed with the contractor and the Engineer</p>



		The Engineer's evaluation shall be under clause 12.			These sheets should be pre-prepared and agreed before the IPA submission
13.5	Provisional sums	<p>The Engineer shall instruct separately to use each provisional sum in part or full and contract price should be adjusted accordingly</p> <p>The payment shall include only such amounts for the works, supplies or services, related to the p. sum instructed by the Engineer.</p> <p>The Engineer may instruct, (a) and (b) [please refer to the clause]</p> <p>The contractor shall produce quotations and accounts etc. as required by the Engineer.</p>	13.6	Adjustment for change in legislation	<p>A change in law during the period 28 days prior to closing of bids and issuing of certificate of completion OR termination entitles contractor for delay or /and cost if the contractor suffers so.</p> <p>The Engineer may receive notice from the contractor for</p> <p>a) EOT</p> <p>b) payment of cost</p> <p>The Engineer shall determine such cost and it shall not include what has already been paid under price escalation.</p> <p>A change in law means – new law, repeal or modification of existing law, any regulation made, or directives issued under them, a change in the judicial interpretation or application by a court prior to the agreement on taxation, rationing, import /export duties etc. beyond the control of the contractor.</p> <p>Engineer shall proceed according to clause 3.4</p>
13.6	Day works	The Engineer may instruct works of minor and incidental natures in a variation on day work basis.	13.7	Adjustment for changes in cost	The Engineer in his monthly evaluation of IPA should adopt the price fluctuation formula, as stipulated in this clause

		<p>If day works schedule is not in the contract this clause is not applicable</p> <p>Before ordering goods, the contractor shall submit quotations to the Engineer.</p> <p>The contractor shall submit invoices etc. when applying for payments</p> <p>For each day the contractor should submit resources used executing the previous day's work,</p> <p>a) name occupation hours of work for labor b) type time capacity and identification number for machines c) quantity and type etc. for materials</p> <p>Agreed records should be in files with the contractor and the Engineer</p> <p>These sheets should be pre-prepared and agreed before the IPA submission</p>			<p>using percentage values given in the Contract.</p> <p>If the completion date goes beyond the intended date of completion OR the extended date of completion current price indices adopted should be those valid up to that date only.</p> <p>The weightings <u>shall only be adjusted if in the opinion of the Engineer</u>, they have been rendered unreasonable, unbalanced, or inapplicable, as a result of varied or additional work already executed or instructed under sub clause 3.3 [<i>instructions of the Engineer</i>] or for any other reason.</p>
13.7	Adjustment for change in legislation	<p>The contract price shall be adjusted to take the increase or decrease of Cost resulting from a change in the laws or judicial or official government interpretation of such laws made after the base date affect the contractor's performance.</p> <p>Such change entitles</p>	14.1	The contract price	<p>The Engineer / employer shall,</p> <p>a) agree or determine the contract price under sub clause 12.3 <i>evaluation</i> and subject to adjustments according to relevant contract conditions</p> <p>b) not adjust the contract price on taxes duties and fees except as per</p>

		<p>contractor for delay or /and cost if the contractor suffers so.</p> <p>The Engineer may receive notice from the contractor for</p> <p>a) EOT</p> <p>b) payment of cost</p> <p>The Engineer shall determine such cost and it <u>shall not include what has already been paid under price escalation.</u></p>			<p>sub clause 13.6 <i>change in legislation</i></p> <p>c) Consider BOQ quantities as estimated values and not accurate and shall be measured under clause 12.0. <i>measurement and evaluation</i></p> <p>d) receive from the contractor within 28 days after the commencement date, a proposed break down of each lump sum price in the schedule and use in preparing monthly IPC</p>
13.8	Adjustment for changes in cost	<p>The Engineer should adopt the price fluctuation formula as stipulated in this clause using 'table of adjustment data' given in the appendix to the tender.</p> <p>In cases where 'currency of index' [stated in the table] is not the relevant currency of payment each index shall be converted to the relevant currency at the selling rate established by the central bank of the country on the above date for which the index is to be applicable.</p> <p>Until such time current cost index is available</p> <p>The Engineer shall determine a provisional index [<i>commonly the</i></p>	14.2	Advance payment	<p>The Engineer shall issue an IPC for the first installment of advance payment after a) receiving a statement, b) after the employer receives the performance and advance guarantee bonds.</p> <p>Recover the advance payment,</p> <p>(i) from IPC,</p> <p>(ii) in proportionate amounts</p> <p>(iii) in full when certified value is 90% of initial contract price.</p> <p>If not recovered prior to the issue of the taking over certificate, [or letter of termination], whole of the balance outstanding has to be deducted</p>

		<p><i>previously available one is used]</i></p> <p>If the completion date goes beyond the intended date of completion OR the extended date of completion current price indices adopted should be those valid for 49 days prior to the expiry of the time for completion OR the current index which is more favorable to the employer.</p> <p>The weightings [coefficients] shall only be adjusted if they have been rendered unreasonable, unbalanced, or inapplicable, <u>as a result of variation only</u></p>			
14.1	The contract price	<p>Unless otherwise stated in particular conditions, The Engineer shall</p> <p>a) agree or determine the contract price under sub clause 12.3 <i>evaluation</i> and subject to adjustments according to relevant contract conditions</p> <p>b) not adjust the contract price on taxes duties and fees except as per sub clause 13.7 <i>change in legislation</i></p> <p>c) consider BOQ quantities as estimated values and not accurate and shall be measured under clause 12.0,</p>	14.3	Application for interim payment certificate	<p>Monthly Interim payment statement has to be in the form approved by the Engineer.</p> <p>This statement shall include items a) to g) <i>[refer the clause please]</i></p>

		<i>measurement and evaluation</i> d) receive from the contractor within 28 days after the commencement date, a proposed break down of each lump sum price in the schedule and use in preparing monthly IPC			
14.2	Advance payment	The Engineer shall issue an IPC for the first installment of advance payment after a) receiving a statement b) the employer receives the performance and advance guarantee bonds Engineer shall recover the advance payment from IPC, as given in Appendix to tender. If not, a) in proportionate amounts, when certified value exceeds 10% of initial contract price less provisional sums. b) deductions shall be at the amortization rate of 25% of the amount of each payment certificate (excluding the advance payment and deductions and repayments of retention) in the currencies and proportions of the advance payment , until the advance payment is fully repaid	14.5	Issue of interim payment certificate	The Engineer shall issue interim payment certificate within 21 days of receipt of the statement from the contractor, after fairly determining the supporting particulars, provided that the performance bond has been received by the employer. The Engineer shall not be bound to issue IPC for an amount below the minimum specified in the contract data. In this event the Engineer shall give notice to the contractor. The IPC shall not be withheld for any reason although, (a) any cost or rectification or replacement can be withheld, (b) any instructed obligation not performed by the contractor after notification, as per contract until it is performed as required.

		If the advance payment has not been fully recovered prior to the taking over certificate or termination, the whole of the balance outstanding amount shall become due and payable by the contractor			The Engineer may make any correction as required on any previously certified and paid amounts.
14.3	Application for interim payment certificate	Monthly Interim payment statement has to be in the form approved by the Engineer This statement shall include items a) to g) <i>[refer the clause please]</i>	14.8	Payment of retention	The Engineer is entitled to withhold any cost for work that is to be executed under sub clause 11 <i>Defects liability</i> , out of the retention money which is to be paid on completion certificate and performance certificate after defects rectification are issued. When calculating these proportions, no account shall be made for adjustments under <i>change of legislation</i> [13.6] or <i>change of cost</i> [13.7]
14.4	Schedule of payments	If the contract includes a schedule of payments specifying the installments in which the contract price will be paid, then unless otherwise stated in the schedule a), b) and c) should be followed <i>[refer the clause please]</i> <i>If the contract does not include a schedule of payments, the contractor shall submit a non-binding estimate during each quarterly periods.</i>	14.9	Statement at completion	The Engineer shall receive the statement at completion from the contractor within 84 days of issuing of completion certificate in 3 copies. The Engineer shall certify according to sub clause 14.5

14.5	Plants and materials intended for the works	<p>If the lists referred to in sub paragraphs (b) (i) or (c) (ii) below are not in the appendix to the tender this sub clause shall not apply.</p> <p>The Engineer shall determine and certify each addition if the following conditions are satisfied (a), (b) and (c) <i>[please refer the clause]</i></p> <p>The additional amount is 80% of the cost of the plant and materials as determined by the Engineer taking account of the documents mentioned in this sub clause and the contract values for plant and materials</p> <p>The currencies for this payment shall be the same as in other payments</p>	14.10	Application for final payment certificate	<p>The Engineer shall approve the form for the draft final statement and receive the same within 56 days of issuing the performance certificate.</p> <p>The Engineer may require further information and make corrections in the draft final statement submitted by the contractor. The contractor will make the changes and submit the agreed final statement.</p> <p>If the final statement cannot be agreed, dispute situation has arisen. So, the Engineer shall prepare and deliver to the employer an interim payment certificate for agreed part with a copy to the contractor.</p>
14.6	Issue of interim payment certificate	<p>The Engineer shall issue interim payment certificate within 28 days of receipt of the statement from the contractor, after fairly determining the supporting particulars, provided that the performance bond has been received by the employer.</p> <p>The Engineer shall not be bound to issue IPC for an amount below the minimum specified in the appendix to the tender. In this event the</p>	14.12	Issue of final payment certificate	<p>The Engineer shall issue the final payment certificate within 28 days of receiving the [agreed] final statement</p> <p>If the contractor has not requested a final payment certificate, the Engineer shall instruct the contractor to do so.</p> <p>Even if not requested by the contractor in 28 days, the Engineer shall issue the certificate as he determines</p>

		<p>Engineer shall give notice to the contractor. The IPC shall not be withheld for any reason although,</p> <p>(a) any cost or rectification or replacement can be withheld,</p> <p>(b) any instructed obligation not performed by the contractor as per contract until it is performed as required. The Engineer may make any correction as required on any previously certified and paid amounts.</p>			
14.9	Payment of retention	<p>When the taking over certificate is issued first half of retention money may be certified by the Engineer for payment &amp; proportionately for the value of work if a part is taken over.</p> <p>This proportion shall be 40% of the proportion calculated by dividing the estimated contract value of the section or part, by the estimated final contract price.</p> <p>The Engineer is entitled to withhold any cost for work that is to be executed under sub clause 11 <i>Defects liability</i>, out of the retention money which is to be paid on completion certificate</p>	15.1	Notice to correct	<p>If the contractor fails to carry out any obligation under the contract, the Engineer may by notice, instruct the contractor to remedy it in a specified period</p> <p><i>[preferably with agreed short targets for selected key activities and even if the contractor is not making an effort, may discuss with the employer for termination -author]</i></p>



		and performance certificate after defects rectification are issued. When calculating these proportions, no account shall be made for adjustments under <i>change of legislation</i> [13.7] or <i>change of cost</i> [13.8]			
14.10	Statement at completion	The Engineer shall receive the statement at completion from the contractor within 84 days of issuing of completion certificate in 6 copies, which shall show (a) to (c) in the clause. The Engineer shall certify according to sub clause 14.6	15.2	Termination by the employer	The Employer can terminate the contract under 7 counts from a) to g) under this sub clause. Out of which those the Engineer is involved are; d) Subcontracts the whole or part of the work without the Engineer's approval.
14.11	Application for final payment certificate	The Engineer shall approve the form for the draft final statement and receive the same within 56 days of issuing the performance certificate. The Engineer may require further information and make corrections in the draft final statement submitted by the contractor. The contractor will make the changes and submit the agreed final statement. If the final statement cannot be agreed then dispute situation has arisen.	15.3	Valuation at the date of termination	The Engineer shall proceed to agree or determine [sub clause 3.4] the values of work, goods and documents, due to the contractor, for the work executed in accordance with the contract

		So, the Engineer shall prepare an interim payment certificate for agreed part with a copy to the contractor.			
14.13	Issue of final payment certificate	<p>The Engineer shall issue the final payment certificate within 28 days of receiving the [agreed] final statement in accordance with sub clause 14.11 and 14.12 and shall state a) and) of the clause [please refer the clause]</p> <p>If the contractor has not requested a final payment certificate the Engineer shall instruct the contractor to do so. Even if not requested by the contractor in 28 days, the Engineer shall issue the certificate as he determines due.</p>	16.1	Contractor's entitlement to suspend the works	<p>If the Engineer fails to certify payments or the Employer fails to pay as per relevant clauses the contractor may after giving not less than 56 days' notice to the employer suspend the work [or reduce the rate of work] until and unless the payment is made. The Engineer shall receive notice if the contractor suffers delay or cost and the claim has to be determined by the Engineer</p>
15.1	Notice to correct	<p>If the contractor fails to carry out any obligation under the contract, the Engineer may by notice require the contractor to remedy it in a specified reasonable time</p> <p><i>[Preferably with an agreed short program for selected activities with the resources to be engaged. Failing which more pressure should be applied on the contractor; even if there is no improvement termination is inevitable-author]</i></p>	16.2	Termination by contractor	<p>The contractor may terminate the contract on 6 counts of which those the Engineer is involved are,</p> <p>a) The Engineer fails to issue the IPC within 56 days of receipt of the statement</p> <p>e) Prolonged suspension</p>

15.2	Termination by the employer	<p>The Employer can terminate the contract under 6 counts from (a) to (f) upon giving 14 days' notice to the contractor</p> <p>The contractor shall then leave the site and <u>deliver any required Goods, contractor's documents and other design documents made by or for him to the Engineer</u></p>	17.4	Consequences of Employer's risks	<p>The contractor shall give notice to the Engineer and rectify the loss or the damage to the extent required by the Engineer. The contractor shall give further notice to the Engineer if he claims time and cost over the damage. The Engineer shall agree or determine under sub clause 3.4</p>
15.3	Valuation at the date of termination	<p>The Engineer shall proceed to agree or determine the values of work, goods, and documents due to the contractor, as soon as practicable after the notice of termination</p>	19.1	Contractor's claims	<p>If the contractor considers of an entitlement for EOT or additional cost, notice should be given to the Engineer;</p> <ul style="list-style-type: none"> <li>- Describing, event, effect and the clause under which the claim is based,</li> <li>- Within 28 days after becoming aware,</li> <li>- Give supporting particulars,</li> <li>- Keep contemporary records at site or other location acceptable to the Engineer,</li> <li>- Keep further records the Engineer requests,</li> <li>- Allow the Engineer to inspect and verify records, submit copies if requested by the Engineer.</li> <li>- Within 84 days of being aware the contractor shall</li> </ul>

					<p>submit a fully detailed statement to the Engineer, OR submit on a later date agreed by the Engineer on contractor's request.</p> <p>If the claim has a continuing effect,</p> <ul style="list-style-type: none"> <li>a) This submission may be considered interim;</li> <li>b) Further claims may be submitted monthly with further particulars as required by the Engineer</li> <li>c) The final claim for this shall be submitted within 28 days after the event has completely occurred</li> </ul> <p>Within 42 days of receiving a claim or any other required particulars, or within such other period the Engineer shall respond approving or disapproving with detailed comments.</p> <p>The Engineer may request further particulars but should give his response on the principle of the claim.</p> <p>The claim may be recommended in parts if accepted based on available particulars only limited to that portion.</p> <p>The Engineer's action will be under sub clauses 3.4 and 8.4 and any other relevant clauses.</p>
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16.1	Contractor's entitlement to suspend the works	If the Engineer fails to certify payments or the Employer fails to pay as per relevant clauses the contractor may after giving not less than 21 days' notice to the Employer, suspend the work until and unless the payment is made. The Engineer may receive notice if the contractor suffers delay or cost and his claim has to be determined by the Engineer Engineer shall determine or agree these matters in the contractor's notice	20.4	Consequences of force majeure'	The contractor after giving notice under sub clause 20.2, may notice the Engineer for delay and cost under 19.1 For EOT under sub clause 8.4 and Cost under 20.1 if the event or circumstance is under (i) to (iv) under sub clause 20.1 respectively. The Engineer shall proceed under sub clause 3.4
16.2	Termination by contractor	The contractor may terminate the contract on 6 counts of which those the Engineer is involved are, b) The Engineer fails to issue the IPC within 56 days of receipt of the statement f) Prolonged suspension under sub clause 8.11	20.6	Optional termination, payment and release	By reason of force majeure, for a continuous 84 days or multiple periodical 140 days hamper of performance, the parties may agree for termination [sub clause 16.3] Upon such termination the Engineer shall determine value of work done and issue payment certificate; as described under (a) to (e) of this clause <i>[refer the clause]</i>
16.3	Cessation of work and removal of contractor's equipment	Engineer shall instruct works for protection of life or property or the safety of work			

17.4	Consequences of employer's risks	<p>The contractor shall give notice to the Engineer and rectify the loss or the damage as required by the Engineer.</p> <p>The contractor shall give further notice to the Engineer if he claims time and cost over the damage, sub clause 17.3 sub paragraphs (f) &amp; (g). The Engineer shall agree or determine under sub clause 3.5</p>			
18.1	General requirements for insurance	The Engineer shall be given notice by the insuring party whenever evidence of payment or policies are submitted to the other party			
19.4	Consequences of force majeure'	<p>The contractor after giving notice under sub clause 19.2 may notice the Engineer requesting EOT under sub clause 8.4 and cost in case of paragraphs (i) to (iv) of sub clause 19.1</p> <p>The Engineer shall proceed under sub clause 3.5</p>			
19.6	Optional termination, payment and release	<p>By reason of force majeure, for a continuous 84 days or multiple periodical 140 days hamper of performance, the parties may agree for termination</p> <p>Upon such termination the Engineer shall determine value of work done and issue payment certificate</p>			

		As described under (a) to (e) of this clause <i>[refer the clause]</i>			
20.1	Contractor's claims	<p>If the contractor considers of an entitlement for EOT or additional cost, notice should be given to the Engineer;</p> <p>Describing, event, effect and the clause under which the claim is based,</p> <p>Within 28 days after becoming aware, Give supporting particulars, Keep contemporary records at site or other location acceptable to the Engineer, Keep further records the Engineer requests, Allow the Engineer to inspect and verify records, submit copies if requested by the Engineer.</p> <p>Within 42 days of being aware the contractor shall submit a fully detailed statement to the Engineer, OR Submit on a later date agreed by the Engineer on contractor's request.</p> <p>If the claim has a continuing effect,</p> <p style="padding-left: 40px;">a) This submission may be considered interim;</p> <p>b) Further interim claims may be submitted</p>			

		<p>monthly with further particulars as required by the Engineer</p> <p>c) The final claim for this shall be submitted within 28 days after the event has completely occurred</p> <p>Within 42 days of receiving a claim or any other required particulars, or within such other period the Engineer shall respond approving or disapproving with detailed comments.</p> <p>The Engineer may request further particulars but should give his response on the principle of the claim.</p> <p>The claim may be recommended in parts if accepted based on available particulars only limited to that portion.</p> <p>The Engineer's action will be under sub clauses 3.5 and 8.4 and any other relevant clauses.</p>			
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## Chapter 6 – How to prepare a quality assurance plan

[For a road construction project]

1. The aim of this chapter is to change the practice of copy and paste TO SUBMIT a QA plan. Please note the word submit; actually, it is to prepare & use; ***but in practice most project/site managers want to submit only, not to prepare one to be used by the site team.***
2. Read [glance through] project scope [in the contract document/instruction to bidders], specification requirements, BOQ, company quality manual if there is one.
3. List out the activities and their sub activities considering the complexity and time gaps needed to complete the activity. Have a rough idea as to how the work will be done.  
*e. g. if ready mix concrete is to be used from supplier; from your own plant or by small mixer or a mobile mixer, for small volumes in scattered places, QA description for concrete production will not be the same, though there are so many sentences to be included commonly in all cases.*
4. BOQ is the first document to be referred to prepare this list. Then add other items you can think of.
5. ***Project quality is not only quality of construction. It matters for everything done in the project. Accommodation of staff and labor, office and stores arrangements, communication – letters and drawings formats for routine exchange of information; organization with sub divisions, duties and responsibilities, work hours, submission of IPA etc.***
6. Read carefully the SPECIFICATION REQUIREMENTS FOR QUALITY OF WORKS under each activity or sub activity based on number 4 above.
7. Under each one, write how you do things to ensure the specification requirements are achieved.
8. Please note that why the quality requirement is needed or the importance of quality of work need not be elaborated here. QA plan is requested as it is important and needed for the project to ensure all in the construction team know the need and what is to be done to achieve quality requirements without fail.
9. Match these with the construction time schedule and deployment of resources

10. Do not refer or indicate “as in company quality manual”. Then the Engineer will request for copies of relevant sections of company quality manual.

**11. QUALITY OF CONSTRUCTION INVOLVES;**

- i) **STRENGTH** [depends on strength of materials used, right mix, method of doing, protection or curing etc.],
- ii) **DIMENSIONAL ACCURACY,**
- iii) **LEVEL ACCURACY,**
- iv) **EVENNESS ACCURACY,**
- v) **NEATNESS IN APPEARANCE,**
- vi) **EXPECTED LIFE TIME. ALL THESE ARE QUALITY CONCERNS.**

12. *For each activity or the portion of work, all these (vi) listed on 11 above as relevant have to be given in brief as to how the specification requirements are achieved*

13. There shall be sub quality plans for office arrangements and functioning, stores and yards, machinery usage, labor accommodations [if relevant], laboratory arrangements and functioning, [This will include even the letter numbering, letter format, font etc. to be uniform for the full period of the project as planned]

14. A list of contents of the QA plan is given as a guide; but cannot be 100% fit for your project, as the needs vary with the project and the level of service and the magnitude of the project.

- a. Project brief
- b. The Project Management System - The site organization chart; The organization and functions of, office, stores, machine unit, laboratory; Their inter relations and communication-- Relationship and communication with, company main office, the Engineer and the Employer/ Employer’s representative, relevant other organizations such as utility authorities, state offices, public.
- c. Project Quality Assurance System, Quality plan for construction which is the main objective *elaborating on avoiding lapses in quality and correction of defects and preventing them as a follow up*
- d. Resource Management
- e. Measurement analysis and improvement
- f. Project Safety Procedure
- g. Environmental Management Plan and Environmental Monitoring Plan

A sample QA plan is given in annex 1 [to read and understand; BUT **NOT TO COPY AND PASTE**]

## Chapter 7 – How to prepare a method statement

[For a road construction project]

1. The aim of this chapter is to change the practice of copy and paste TO SUBMIT a Method Statement. Please note the word submit actually expects to prepare, forward to the Engineer and with his consent adopt in site.
2. Read [glance through] project scope [in the contract document/instruction to bidders], specification requirements, BOQ, drawings and your QA plan.
3. List out the activities and their sub activities considering the complexity and time gaps needed to complete the activity. Have a rough idea as to how the work will be done.
4. BOQ is the first document to be referred to prepare this list. Then add other items you can think of from other documents, such as contract clauses, specifications, QA plan, and construction program submitted at the bid.
5. Read carefully the DRAWINGS, SPECIFICATION REQUIREMENTS FOR QUALITY OF WORKS and *CONSTRUCTION REQUIREMENTS* under each work item, safety and environmental safeguards etc. if specified in the tender.
6. Under each one, write how you do things to ensure the contract conditions, specification and drawing requirements are achieved.
7. Quality of construction involves i) strength [depends on strength of materials used, right mix, method of doing, protection or curing etc.], ii) dimensional accuracy, iii) level accuracy, iv) evenness accuracy, v) neatness in appearance, vi) expected life time. All these are quality concerns.
8. *For each activity or the portion of work, all these (vi) listed on 7 above as relevant have to be given in brief as to how the specification requirements are achieved*
9. Contents – Method Statement
  - A. Land acquisition assistance [ depends on project]
  - B. Site survey
    - i. Establishing control points and TBM;
    - ii. Setting out C/L and ROW;
    - iii. Checking flat plan issued and revising;

- iv. C/S survey;
  - v. Junction detail survey and C/Ss of by roads
- a. Culvert and structure survey – existing condition with opening size , type and photos; missing culverts in the list, New introductions as per the list, Omissions in the design proposal [if suitable]
  - b. Property survey—parapet walls and fences type etc.; house and their conditions and distance from road centerline; photos and especially any cracks seen. For likely insurance claims or acquisition needs; danger locations where people to be evacuated during construction due to vibration [if any]
- C. Drawings – Generally in road projects the contractor is given the responsibility to prepare the working/construction/shop drawings which means to adopt the type drawings to suit the site conditions and get the Engineer’s approval before construction can start; preparation of structure drawings; -- preparation of road drawings; Obtaining Engineer’s approval; --preparation of constructed drawings in stages for IPA; -- preparation of as built drawings at completion
- D. Routine approvals [as in QA plan] – who is responsible for each activity; By whom & how will be submitted and collected; -- who will incorporate with IPA
- E. Construction of structures-
- Culverts – excavation; shoring, dealing with water, forms, r/f, concrete, curing, weep holes backfill etc.
  - Drains --excavation; dealing with water, forms, r/f, concrete, curing, backfill etc.
  - Retaining walls etc. -- excavation; shoring, dealing with water, forms, r/f, scaffolds, concrete, curing, weep holes backfill etc.
- F. Construction of road
- i. Clearing and grubbing,
  - ii. Trim level and compact;
  - iii. Soft ground treatment [if any]
  - iv. Embankment fill type 2 below 1.0 m from FRL
  - v. Embankment ill type 1
  - vi. Sub base I & II
  - vii. ABC fill on sub base and on macadam surface
  - viii. Light and hard scarification
  - ix. Shoulder construction

- x. Turf & tree planting
  - xi. Bituminous work in brief [ These will have to be explained in detail before the construction starts]
  - xii. Road marking and road furniture
- 
- G. Environmental safeguard actions
  - H. Social safeguard actions
  - I. Traffic control and safety of road users and personal safety arrangements for the workers and staff
  - J. Handing over
  - K. Defect correction period – reduced staff organization and duties and responsibilities

A sample Method Statement is given in annex 2 [to read and understand; BUT NOT TO COPY AND PASTE]

## Chapter 8 - Preparation of a supervision manual

This is a requirement for the consultancy firm to fulfill their obligations at the beginning of a construction supervision contract. *[Normally the Team Leader prepares this. In case as a Senior RE, you have to prepare, or assist. I wish those who developed their carrier with me could be able do it on their own]*

1. The idea is to be,
  - clear of the process of supervision by the supervision team
  - aware and monitor if felt necessary the activities of the consultancy by the employer
  - sure, that the expected, is delivered by the consultancy
2. The scope of the document should cover
  - TOR requirements of consultancy agreement [sometimes donor agency requirements if issued]
  - Engineer's role as expected in the construction contract from which the Engineer and his staff get authority of supervision and the limitations of authority [general and particular conditions of contract] from the issuance of the letter appointing the Engineer for the contract by the Employer to the Contractor with a copy to the consultancy company
  - Supervision requirements in general and particular/special specifications for construction contract
3. The supervision consultancy involves
  - Dealing with the Employer and satisfying the agreed obligations within target times
  - Dealing with the Construction contractor(s) and carrying out duties and enforce authority derived from the conditions of construction contract signed with the contractor.
  - Dealing with the relevant outside organizations depending on how responsibilities are stated in the documents [Generally this role is with the Employer but in some documents a part is given to the contractor and Employer to assist as and when required. Mostly the Engineer is to do the coordination role and reminder role to the parties to the contract]
4. Dealing with the Employer generally consists of
  - Correspondence with the Employer as well as sending required copies of correspondence with the contractor as stipulated or later requested
  - Arrangement and coordination of meetings - regular and special as per contract(s)
  - Preparation and circulation of minutes of meetings

- Reminding any target date for the Employer as per agreed contract (s) if a need arises [commonly - extension of bonds and insurances by the contractor]
- Deliverables [as in TOR] e. g. Inception, monthly, quarterly, completion reports etc.
- Issuing certificates- interim payments, final payment and completion certificate
- Recommendations – for variations, EOT, extra works, projected cost estimates for adequacy of funds or to seek extra funds

5. Dealing with the Contractor generally consists of,

- Correspondence with copies to Employer as stipulated or agreed later
- Instructions will be numerous [- Reminders for Contractor's obligations unattended in time ; This is not a situation to call that the Contractor was instructed to do something lately and there is NO claim for EOT or anything; -- New instructions not covered in the scope but required due to unexpected conditions or on Employer's request; For such instructions the Contractor may send notice of claim and quick action should be taken in consultation with Contract specialist (officially appointed or from a senior, in private capacity even) and the Employer should be made aware of.--- required work reminders will be mostly verbal and a record has to be kept if the contractor has not proposed a CVI [confirmation of verbal instructions] system. Always better to do a written request not by letter but by agreed forms such as field orders; No stop order or change order should be given unless at an emergency; These are likely claim points and the Engineer is vulnerably placed if not well thought and proper procedure is followed]
- Approvals are of two types. Initial approvals for material source, construction program, QA, environmental and social monitoring plans, method statement etc. The others are periodic ones such as daily work, tests, inspection to start activities, measurements etc. and approval of key staff of the contractor.
- Next one is the monthly interim payment applications and their certification. For this, regular site measurements for structures and isolated works in road construction will be done then and there when work is done and before covering. All road work as per specification has to be calculated from the c/s drawings prepared and agreed. The c/s interval and spot height intervals are specified. But any suitable changes can be agreed by the Engineer as stated in FIDIC under formats for payment documents to be agreed with the contractor. In strict sense every time work is completed for each type of material, joint levels should be taken, plotted and accepted for quantity calculations. If this is not done regularly cunning contractors make claims at the end and the Engineer is blamed by many Employers. Also, it should be noted that the IPC should be issued in time. [If the contractor's IPA has shortcomings, the Engineer shall call the representative and resolve doubts etc. and certify in specified time, if delayed, inform the contractor and certify what is possible and cut off incomplete items, do not keep the IPA with the Engineer too long than required, never after stipulated date]
- Notices for new rates, EOT, exceeding quantities, unforeseen ground or other conditions are common types of letters the Engineer has to take action. This should be carefully done. Always, refer the relevant contract clauses and records, reply within stipulated time, refuse the notices which are late or incomplete, instruct to keep joint



contemporary records, and if the contractor is insisting, even if in your view is that there is no claim. For an obvious no claim situation, reject firmly and instruct to take future contractual action without bothering unnecessarily **[means go for dispute resolution]**; but never write it openly; the contractor will then say you instructed and the Employer will be unhappy and it will be disadvantageous in the dispute resolution process too,]

6. Dealing with other parties

These are numerous depending on the project and the environment. But there will not be more than a dozen letters with any one party. So may be handled as miscellaneous work or in a few related files. Thus, it is not discussed in details in this document. It is a more or less commonsense work

7. The Supervision manual document should contain

- brief notes as to how the above requirements are met
- How information is passed
- Who is responsible,
- How authority is delegated

8. The clearest way of presenting these with a brief description followed by a flow chart of activities

9. Regarding delegation of authority please note,

- The Engineer or Team Leader gets authority by the letter issued to the contractor by the Employer with a copy to the consultant that Mr. X or the organization is appointed as the Engineer for the project.
- Though in some project, the consultancy firm is mentioned as the Engineer; it leads to problems; best is to provide a name- a person holding a post and include his successor too.
- Mr. X or his successor can delegate authority which he automatically gets as per the contract conditions
- There are authority clauses and responsibility clauses in the conditions of contract. Some are written under headings some are coming in Contractor's obligation clauses in a phrase such as 'after obtaining Engineer's approval'. So, this is the clause that gives responsibility and authority not written under the heading - Engineer.
- It is good to list all these clauses from the conditions of contract in a table form and stating the responsible person or persons. Then there will be NO un-delegated authority items



A sample list of duties is given below

### **LIST of DUTIES**

**Team Leader [= Project Manager in this sample project]**

1. Leading the team to meet the project requirements, balancing the mismatches in the TOR of consultancy agreement and the supervision needs of the construction contract, within limits in the best possible manner
2. All correspondence with the contractor and the employer
3. Coordinating and utilizing services of visiting staff, i. e. QA manager, Highway Design Engineer & Contract specialist
4. Approval of construction program, method statements and QA manual
5. Preparation of measurement / payment application formats to be agreed with the contractor
6. Preparation of formats for reports, routine records,
7. Approval of method of construction on special works and in emergency situations
8. Analysis of contractor's claims and send for perusal by contract specialist
9. Decide on required structure modifications to be presented to the employer's acceptance
10. Initiating Taking over process

#### **A. Construction supervision team**

##### **1. Resident Engineer (RE)**

- 1.1 Assisting PM/TL on all contract related matters
- 1.2 Act for PM/TL in his absence from site for a day or more
- 1.3 Approval of drawings submitted by the contractor
- 1.4 Coordinating with QS and recommending payment certificates for TL/PM's certification
- 1.5 **Guide the Secretary cum Office manager in record keeping and retrieving** [*main aim is for being able to defend claims*]
- 1.6 **Take responsibility of all correspondence handled by the office**
- 1.7 Preparation of minutes of meetings until the secretary develops to take the responsibility
- 1.8 Preparation of monthly and quarterly reports with the guidance of TL

- 1.9 Check running chart and vehicle movement and certified records by SE & ME and hand over to secretary to be sent for payments to main office
- 1.10 **Check Office manager/secretary's work is proper and registers are updated and letters are filed properly** [*key for being able to defend claims*]
- 1.11 Consult TL to stop work. No single- handed decision is authorized on this matter
- 1.12 Officially receiving Request for Inspection [RFI] through the secretary and distributing to SE/ME

## **2. Site Engineer (SE)/ARE**

- 2.1 Keeping record of request for inspection [RFI] from contractor through Secretary [who will physically receive the sheet; - depends as per accepted QA manual]
- 2.2 Ensure being available at required places by TO/ME/SSO/RE/ESO as the case needs
- 2.3 Obtain guidance from RE/TL to ensure no mistake is committed on supervision or approval matters from the PM[TL]'s staff
- 2.4 Assist PM/TL in computer checking of drawings, if so required
- 2.5 Be in charge of the vehicle provided for the supervision team and ensure transport of the team 2 TOs, Surveyor and SE.
- 2.6 Ensure transport needs of ME and MT are met
- 2.7 Release the vehicle to SSO and ESO needs, without affecting site work; inform RE/TL if not possible
- 2.8 Check running chart and vehicle movement and certify records and ensure Secretary cum office manager sends them properly and in time to main office in Colombo
- 2.9 Bring to the notice of PM/TL or RE any deviations in construction from drawings, or QA manual observed at site as soon as possible depending on the gravity of the problem immediately or within the day.
- 2.10 Consult PM/TL to stop work. No single- handed decision is authorized on this matter
- 2.11 Ensure the contractor's daily planned work is not hampered because of any reason by PM[TL] 's staff
- 2.12 Check Office manager/secretary work is proper and registers are updated and letters are filed until RE takes complete control over this work
- 2.13 Checking As- built drawings on completion

## **3. Materials Engineer (ME)**

- 3.1 Receiving and keeping record of request for testing [RFT] of materials [at the lab] or works [at site] from RE [who will physically receive the sheet, - depends as per accepted QA manual]
- 3.2 Ensure being available at required places by MT/SE as the case needs

- 3.3 Obtain guidance from QAM [PM/TL in his absence] to ensure no mistake is committed on witnessing or approval matters from the PM's staff
- 3.4 Be in charge of the vehicle [when provided] for the testing team and ensure transport of the others [SSO & ESO] in sharing without affecting the work
- 3.5 Check running chart and vehicle movement and certify records; hand over to RE
- 3.6 Bring to the notice of PM/TL or RE any deviations in construction from drawings, QA manual observed at site as soon as possible depending on the gravity of the problem immediately or within the day.
- 3.7 Consult PM/TL to stop work. No single-handed decision is authorized on this matter
- 3.8 Take part in subsoil investigation where so decided by the project
- 3.9 Ensure the contractor's daily planned work is not hampered because of any reason by PM's staff

#### **4. Traffic and safety Engineer**

- 4.1 monitor traffic and safety arrangements at site
- 4.2 prepare weekly report on those matters and send to contractor under TL's signature
- 4.3 Follow up contractor's corrective action
- 4.4 Assist RE and SE in their duties
- 4.5 Assist in preparation of periodic reports by being the coordinator to complete different sections of the report prepared by sectional officers and hand over to RE to finalize the report by 20th of the following month

#### **5. Technical Officer**

- 5.1 Get directives from SE [in absence of him from RE]
- 5.2 Get guidance from RE/TL regarding specifications and QA manual and method statement
- 5.3 Read and understand specification requirement for each type of work, well before the activity starts as per construction program
- 5.4 Supervise construction works to ensure use of approved material, correctness of levels and lines, achievement of proper finish, cleanliness of work, and work place
- 5.5 Check setting out of road or structure work with the help of the surveyor where such help is required
- 5.6 Witness and check field tests carried out by the contractor's staff in absence of ME or MT
- 5.7 Check work by inspection of the place to receive construction material, for cleanliness, dryness, or moistness required as per specifications, correctness as per drawings
- 5.8 Taking joint measurements of work that may be physically covered by the work to start next

- 5.9 Taking joint measurements on request by the contractor's staff as at agreed stages and manner [i. e. follow standard method of measurements] as in specifications and BOQ
- 5.10 Assist SE in record keeping of RFI and measurements
- 5.11 Assist QS in checking payment certificates where required, regarding the measurements jointly taken by the TO

## **6. Materials Technician**

- 6.1 Get directives from ME [in absence of him from RE]
- 6.2 Get guidance from PM/TL regarding specifications and QA manual and method statement
- 6.3 Read and understand specification requirement for each type of work, well before the activity starts as per construction program
- 6.4 Witness and check field tests carried out by the contractor's staff as per the request forms/daily program
- 6.5 Assist ME in record keeping of RFT and test report copies
- 6.6 Assist QS in checking payment certificates where required, in identifying relevant test references

## **7. Surveyor**

- 7.1 Get directives from SE [in absence of him from TL/RE]
- 7.2 Get guidance from TL/RE regarding specifications and QA manual and method statement
- 7.3 Liaise with contractor regarding establishment of survey control points
- 7.4 Supervise proper undisturbed maintenance of them by the contractor
- 7.5 Check all surveying and leveling works done by the contractor
- 7.6 Keep all needed records of survey work for accurate construction as well as for measurement/payment purposes
- 7.7 Suggest suitable changes to alignment within ROW available and levels to SE and TL to be decided for implementation after discussion with PM and the employer
- 7.8 Assist QS in checking payments where required, regarding surveying & leveling works
- 7.9 Assist the SE and TO in supervision works when not involved in surveying related works
- 7.10 Guide the Drafter on road work drawings and plotting and area /volume calculations
- 7.11 Assist SE/RE in checking as built drawings

## **B. Other staff**

### **1. Quantity Surveyor [QS]**

- 1.1 Receiving from Secretary cum Office manager and checking all payment applications submitted by the contractor
- 1.2 Keeping necessary records for checking payment applications
- 1.3 Preparation of variation orders under the guidance of PM/TL and submission for his checking and recommendation to be submitted to the employer
- 1.4 Preparation of required rate analyses
- 1.5 Preparation of half yearly revised BOQs with the guidance of PM
- 1.6 Assist RE and secretary to prepare monthly progress reports
- 1.7 Provide RE with information regarding financial progress for progress review meetings at site or ministry
- 1.8 Keep track of expiry dates of bonds and insurances
- 1.9 Keep a record of EOT approved and assist PM to inform to the contractor as well as those in the process
- 1.10 Keep a record of all payments made
- 1.11 Checking of final account

### **2. Drafter**

- 2.1 Prepare all drawings as directed by surveyor, SE, RE or PM
- 2.2 Check drawings plotting sent from the contractor under the guidance of relevant officers
- 2.3 Calculate quantities from road drawings
- 2.4 Keep records of own work under the guidance of SE and Surveyor

### **3. Secretary cum Office manager**

- 3.1 Assisting the Project manager in managing the office matters.
- 3.2 Typing of letters with correct letter reference numbers.
- 3.3 Keeping a record of incoming and outgoing letters in hard register.
- 3.4 Maintaining an excel register of all correspondence including e-mails faxes and letters exchanged in such a way that needed letter can be sorted by date, reference number or first few words of the heading.
- 3.5 Making arrangements for the meetings held in this office.
- 3.6 Handling petty cash and dealing with reimbursement process.
- 3.7 Preparation and collection of duly filled time sheets and sending to main office with PM's signature.

- 3.8 Maintaining vehicle running chard records for the month obtaining regularly and properly from the officers in charge of vehicles.
- 3.9 Settlement of dues to the officers and keeping necessary records for payments agreed with the main office.
- 3.10 Liaise with the service providers and settle them as per the agreements made with main office for cleaning, electrical and plumbing services and computer hardware and software matters.
- 3.11 Assist RE for preparation of monthly invoice support documents.
- 3.12 Distributing minutes of meetings as directed by RE
- 3.13 Any other duties signed by PM/TL will be added.

#### **4. Office helper**

- 4.1 Open the office before others come and close after others have left
- 4.2 Ensure the lights, computers and A/C are switched off and on as required
- 4.3 Attend PM's bell calls
- 4.4 Preparation of refreshment etc. for meetings
- 4.5 Assist secretary on filing letters in correct files in proper order
- 4.6 Any other duties signed by PM will be added.

### **C. Visiting staff**

#### **1. Quality Assurance Manager (QAM)**

- 1.1 Co-ordinate with PM/TL [RE in PM/TL absence] at times of visits to site
- 1.2 Liaise with PM/TL and contractor's relevant staff on quality related matters
- 1.3 Approval of source materials of all types and mixes proposed by the contractor through RE
- 1.4 Approval of laboratory for PM's acceptance in writing
- 1.5 Checking calibrating certificates of necessary instruments at the right intervals of time
- 1.6 Assisting RE in checking QA manual and method statements
- 1.7 Guiding the ME and MT
- 1.8 Assist the team in evaluation of subsoil condition
- 1.9 Assist PM/TL in base strengthening decisions
- 1.10 Half -yearly system audit to ensure QA proposal is effectively implemented in the project and making proposals to achieve aim of QA manual

#### **2. Highway Engineer**

- 2.1 Coordinate with PM and main office Consultants on times of visits to site
- 2.2 Liaise with RE and CR during site visits



- 2.3 Inspect and propose needed changes /report to PM and Consultants

### **3. Contract Specialist**

- 3.1 Visit site on request. Visit site and study issues with PM/TL when dispute situation is declared by Contractor or employer
- 3.2 Coordinate with PM/TL and main office Consultants on times of visits to site, if situation in 3.1 has not arisen
- 3.3 Assist and guide PM/TL on request regarding EOT matters, Variations
- 3.4 Contractor's claim evaluation

### **4. Social safeguard officer [SSO]**

- 4.1 Assist PM/TL on all matters related to social aspect of the project
- 4.2 Monitor social safeguard specification requirement being implemented at site.
- 4.3 Observe at site any deviations or omissions and report to PM /TL.
- 4.4 Prepare drafts or make comments on all correspondence received on social matters from any party and give to PM / TL.
- 4.5 Assist PM/TL in preparation of monthly progress report with regard to social aspects of the project following the requirements of appendix B of the contract document.
- 4.6 Be aware of the true situation regarding property condition and access survey carried out by the contractor before construction in selected work sections.
- 4.7 Initiate /coordinate/ participate grievance redress committee [already formed by PIU] matters representing the consultants.
- 4.8 Coordinate the HIV/AIDs program with the contractor on request by the PIU, as and when needed

### **5. Environmental safe guard officer [ESO]**

- 5.1 Assist PM/TL on all matters related to environmental aspect of the project.
- 5.2 Monitor environmental safeguard specification requirement being implemented at site.
- 5.3 Observe at site any deviations or omissions and report to PM /TL
- 5.4 Prepare drafts or make comments on all correspondence received on matters from any party and give to PM / TL.
- 5.5 Assist PM/TL in preparation of monthly progress report with regard to environmental aspects of the project following the requirements of appendix B of the contract document.
- 5.6 Be aware of the true situation regarding property condition and access survey carried out by the contractor before construction in selected work sections.

- 5.7 Initiate /coordinate/ participate grievance redress committee [already formed by PIU] matters representing the consultants.

## Chapter 9 – How to submit a contractor's claim – under FIDIC

[FIDIC = Federation Internationale Des Ingenieurs Conseils (A French term)].

1. Notice – Contractor
2. Acceptance /rejection – Engineer
3. Contemporary records – Contractor
4. A. Claim; B. Request for time more than 42 days - Contractor
5. Response - Engineer
6. Determination – Engineer
7. Acceptance and Payment – Employer
8. Disagreement –Contractor OR Employer
9. Refer to DB

1. Notice of claim: [This has been explained in chapter 3 also; for sake of completion and ease of reference, included here too.]

- 1.1 The notice should be made under sub clause 20.1
- 1.2 Should be submitted before 42 days from KNOWING the event or circumstance OR the date the contractor SHOULD HAVE BECOME AWARE
- 1.3 Note the paragraph 2 of the sub clause: 'If a contractor fails to give notice within 28 days the contractor shall not be entitled; the Employer shall be discharged from all liability in connection with the claim'
- 1.4 The contractor **shall submit** any **other notices** which are required by the contract and supporting particulars for the claim, all as relevant to such event or circumstance

This may be summarized as things to be included in the claim notice

- Event or circumstance occurred/ arisen with supporting particulars
- Relevant contract clause or clauses in addition to sub clause 20.1, giving the entitlement for the claim
- Effect of the event/circumstance to the contractor's performance: time, cost, or both

2. Acceptance or rejection and Contemporary records

- There is no fixed time limit for the Engineer to accept the notice or reject it
- The Engineer should give reasons if he rejects
- If the contractor disagrees with the Engineer, he has to decide whether he considers it as dispute and take action under clause 20

- If the Engineer accepts the notice, it is better to agree procedure to keep contemporary records
- Even if the Engineer does not request the contractor has to keep contemporary records [acceptable to the Engineer] --- see paragraph 3 of the sub clause 20.1
- If the contractor keeps records on his own, he should,
  - Inform the Engineer
  - Permit the Engineer to inspect the records
  - Submit copies to the Engineer
- The Engineer should
  - Monitor the records
  - May ask for further records WITHOUT ADMITTING THE EMPLOYER'S LIABILITY
- If the Engineer is silent on the notice of claim, yet the contractor shall follow with contemporary records as above
- If this is not done it will be difficult for the contractor to prove his point in the evaluation of claim i. e. Determination by the Engineer.

### 3. Claim proper

- 3.1 The claim should be submitted within 42 days of the event
- 3.2 If it cannot be prepared within 42 days the contractor should make a request to submit on a subsequent date giving reasons and with the Engineer's approval it can be submitted on or before the agreed date
- 3.3 The claim proper shall be a fully detailed claim. This has to include the following
  - Claim notice submitted
  - Relevant contract clauses giving rise to the entitlement
  - Event / circumstance and its effect
  - How the entitlement is evaluated
  - Supporting particulars [contemporary records and any other]
  - Final EOT [Extension Of Time] or Payment expected
- 3.4 If the event/circumstance gives rise to a continuing effect,
  - Full detailed claim can be submitted for the agreed period
  - This claim may be considered as interim [sub clause 20.1 (a)]
  - Further interim claims can be submitted at monthly intervals giving the accumulated delay or the amount with all the particulars the Engineer may require [sub clause 20.1 (b)]
  - The final claim of the event/circumstance shall be submitted within 28 days of the end of the event/circumstance OR
  - Within such other period proposed by the contractor and approved by the Engineer [sub clause 20.1 (c)]

#### 4. Response:

- 4.1 The Engineer shall respond to the claim within 42 days
- 4.2 The response may be approval, disapproval with detailed comments OR
- 4.3 Request for further clarification and supporting documents. But shall give his response on the principle of the claim
- 4.4 In this process the Engineer shall follow the sub clause 3.5 [Determination]
- 4.5 It should be noted that the Employer's concurrence and /or approval are required in some contracts under particular conditions of contract. This is to be very seriously taken as COST & TIME are concerned
- 4.6 Under sub clause 3.5,
  - The Engineer is required to consult with each party to reach agreement
  - If agreement is not possible the Engineer shall make fair determination under the circumstances

#### 5. Determination:

- 5.1 Unless there is restriction in the particular conditions of contract, the Engineer need not seek Employer approval. But it is good to keep the Employer aware of all claims
- 5.2 If so required, in the first instance, the Engineer should seek Employer's approval together with his response to the contractor within the 42 days
- 5.3 The determination /recommendation shall be as per No4 above

#### 6. Acceptance and payment

- 6.1 The Employer may accept the Engineer's determination and make payments accordingly
- 6.2 If the Employer disagrees, it should be referred to DB [Dispute Board] under sub clause 20.4
- 6.3 If no action is taken, it will lead to dispute by the contractor and may lead to payment of interest too.

#### 7. Disagreement and referring to DB

- 7.1 DB appointment is a must in contracts under FIDIC. If not done at the start of the contract, DB has to be appointed under Ad-hoc basis.
- 7.2 Many who are eligible to be Members of DB do not like to be appointed on ad-hoc basis. If agreed they will not undertake to give the decision within 84 days as a condition.

- 7.3 If the contract so requires referring to DB before Arbitration process is started, appointment of DB is a must.
- 7.4 These should be thought at the beginning of a contract or at least when the first claim notice is received.
- 7.5 If not, the contract will drag on and on and PARTIES WILL BLAME EACH OTHER

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## Chapter 10 – How to prepare a project completion report [For a road project]

1. Normally for donor bank funded projects this is a requirement by the bank from the ministry who generally signs the loan agreement.
2. This document is to be prepared on their need and hence the format they need has to be followed
3. Simply the report should contain a very brief summary of the quarterly [if not, monthly] reports submitted for the project sans any shortcomings corrected later, together with important matters from signing the loan agreement to completion [and closing of the project fund, if so]
4. *Most of the times the Project consultants are not aware of the matters, from the time of signing the loan agreement, though the responsibility is given to them. But they have to coordinate with the PIU, PMU, and the Ministry to get these information and draft copy will be discussed and exchanged a few times before the report is finally accepted by the PMU or the Ministry,*
5. *The main aim of these is for all to say the project was a success. Unless some disastrous situation occurred and it has to be mentioned, in general everything has to be under the carpet unless reported in the monthly progress reports. All the shortcomings should be corrected and a satisfactory project is the end result. The theme of the report is 'in the end everything was good and all dispersed happily' as we ended stories when we were kids.*
6. CONTENTS are as given below  
[This is for a project of multiple contracts in different provinces]
  - I. Project Description
    - A. Objectives
    - B. Components
    - C. Implementation Methods
    - D. Description and Justification of Changes
  - II. Project Implementation
  - III. Initial Operations
  - IV. Evaluation of the Donor Bank's Performance

### Appendices

1. Project Design and Monitoring Framework
2. Contract Packages

3. Project Management Organization Structure
4. Donor Missions and Project Coordination Meetings
5. Contract Implementation Chart
6. (Individual) Contract Detail Summary Sheets
7. (Individual) Contract Quality Assurance Summaries
8. [Performance based -Routine] Maintenance in [Road] Contract Provisions
9. Contractor Performance Assessments
10. Project Implementation Consultancy - Summary
11. Report of the Project Performance Management System (PPMS) Study on Project Roads (in the province)

## Figures

1. Site Map of Projects in the district

**Outline of a sample report is available [see annex 4]**

===== 00000000 =====

Sometimes the consultant gives a **sub project report** and the Project Monitoring / management unit prepares the full report for the projects under the fund

**In such a situation the sub project report may consist of the following [see annex 3]**

1. Project background in brief, as given in monthly /quarterly progress reports
2. Scope of work
3. Contract details
4. Organization charts of the contractor, The Engineer and the Employer [representative's office]
5. Quality aspects
6. Payments in table form the IPC values and dates of request and payments
7. Variations and total cost in comparison with original contract sum
8. Any special issues settled or gone for dispute resolution
9. If a dispute is unresolved, the status of it
10. If no claim certificate is issued, a copy of it
11. If an operation manual is prepared, a brief of it



## **Annexure – 1 - Sample Project Quality Manual**

# PROJECT QUALITY MANUAL

## Chapter 1

### INTRODUCTION

#### 1.1 General Introduction

This Project Quality manual describes and sets out the management arrangements for the..... Funded Road Improvement & Rehabilitation and maintenance of .....km rural roads in ..... district in the ..... province. It describes the Project Management System, Project Quality Assurance System, Resource Management, Product Realization, Measurement, Analysis and Improvement, Project safety procedure, Method Statements for key construction elements and Project Environmental Management Action Plan.

#### 1.2 The Project Management System

The Project Management System describes and sets out management arrangements to complete the project on schedule within the budget and required quality standard specified in the contract.

#### 1.3 Project Quality Assurance System

The Project Quality Assurance System is intended to assure that the quality of all construction works strictly confirms to project requirements. The Project Quality Assurance System shall meet the specified requirements of the contract package No. ....

#### 1.4 Resource Management

Resource Management describes the management of human resources, infrastructure and work environment.

Human Resources –Includes competence, training and awareness of all staff, workers and operators involved in the project.

Infrastructure & work environment- Includes project office, Laboratory, staff & labour quarters, work place, utility services and construction machineries & equipment.

#### 1.5 Product realization

Product realization describes all activities related to the project which consists of planning, designing, communication, purchasing, identification, traceability, preservation, monitoring and calibration of measuring equipment.

#### 1.6 Measurement analysis and improvement

This describes planning and implementing the monitoring process for measurement analysis and improvement. This process will ensure the conformity of the Quality Management System (QMS) and continual improvement of the effectiveness of the QMS.

### **1.7 Project Safety Procedure**

The project safety procedure describes and sets out the personal safety, machine safety and safety for external parties and safety arrangements of traffic during construction of road work.

### **1.8 Environmental Management Plan and Environmental Monitoring Plan**

The Environmental Management Plan describes and Environmental Monitoring Plan sets out management arrangement in order to avoid/minimize the harmful effects to the environment and monitoring plan.

**Chapter 2**  
**PROJECT BRIEF**

Serial No	D.S.Division	Code	Road Name	Road Category	Length (km)
Total					

**2.1 General road information:**

Total Length: ..... km

Type of surface: Asphalt paving

Carriageway width: 4.0 m Minimum (PRDD Roads)  
3.0 m Minimum (PS Roads)

Soft Shoulder Width: 1.0 m

Drains: Earthen trapezoidal and concrete U type & shoe type as shown

**2.2 Details of Contract**

1. Commencement Date: .../ ... /2018

2. Completion Date: ../..../ 2020

3. Construction Period: 700 days for Civil Works and thereafter 3 years for Performance –Based Maintenance Works

4. Contract Amount: Rs: 1,000,000,000/ (Without VAT)

5. Advance Payment:	20% of the accepted contract amount
6. Performance Security:	10% of the accepted contact amount less the value of performance- based maintenance for 3 years
7. Delay damages for the works:	0.1% of the contract price per day
8. Maximum Amount of Delay Damages:	5% of the accepted contract price
9. Percentage of Retention:	10% of certified value of work
10. Limit of Retention:	5% of the accepted contract amount
11. Minimum Amount of Interim Payment:	1.5% of the accepted contract amount
12. Defects Notification Period:	365 Days (After the completion of civil works)

## **Chapter 3**

### **PROJECT MANAGEMENT SYSTEM**

#### **3.1 Introduction**

The Project Management System describes and sets out the management arrangements to complete the project on schedule, within the budget and required quality standard specified in the contract.

The Project Manager is responsible for planning, organizing and controlling of the project from inception to completion by ensuring the project completion within the budget, time and specified quality standard.

The Project Manager shall designate Quality Assurance Manager who shall be directly responsible for overseeing the overall quality assurance plan for this project. The Project Manager shall designate Deputy Project Manager, Design Engineer, Materials Engineer, Site Engineers, Quantity Surveyors, Technical Officers, Surveyor & other technical and clerical staff to execute project activities according to the contract.

#### **3.2 Site Organization chart**

See annex 3.2 A

#### **3.3 Authorities and Responsibilities**

##### **3.3.1 Project Manager (PM)**

- a) Act as Contractor Representative
- b) Responsible for Attending Management review Meetings and progress review meetings.
- c) Responsible for timely valuation of work and submission of the invoice to the client.
- d) Attending meeting with Client/Consultant and inform the matters discussed.
- e) The Director and site staff for the necessary action.
- f) Taking responsibility for reviewing supplier/sub- contractor performance and reporting at Management meetings.
- g) Reviewing and approving work plans prepared by Site Engineer.
- h) Monitoring the standards of workmanship of employees and providing work Instruction to the staff including skilled and unskilled workers.
- i) Collecting and forwarding data relating training needs of the staff members for management review meetings when necessary.
- j) Initiating training of personnel and establishing and maintaining records of training given to the employees of all categories.
- k) Fixing responsibilities on lapses and giving verbal or written warning to the particular employee.

### **3.3.2 Deputy Project Manager (DPM)**

- a) Control the progress and quality of works.
- b) Setting monthly and weekly targets to the subordinates.
- c) Overall safety management of the site.
- d) Monitoring progress against the master program.
- e) Ensuring conduct of work according to project specification and drawings.
- f) Over- seeing implementation of Quality Assurance System related to works.
- g) Responsible for planning and monitoring of construction programme in accordance with master programme.
- h) Prepare monthly construction programme.
- i) Represent meeting with the client / Engineer relating to the planning matters.
- j) Prepare material requirement schedule as per the project plan in consultation with the PM
- k) Submission of daily work program.

### **3.3.3 Quality Assurance Manager (QAM)**

- a) Present meeting with the client/Engineer relating to the quality Assurance matters.
- b) Responsible for the site quality checks of all materials used for permanent works with the assistance of Quality Assurance Inspectors.
- c) Instruct / guide ME, MT & QAI regarding the quality assurance works & documents.
- d) Random checking for dimensions and accuracy of the formwork, reinforcement and etc., prior to concreting/ before the consultant's inspection.
- e) Report at management review meetings on Quality matters and authorization and amendments to Site Quality Assurance Procedures in consultation with the Project Manager.
- f) Reviewing and control of work instructions and forms.
- g) Holding master copies of all quality related documents.
- h) Approval and maintenance of supplier's list.
- i) Identifying the type and frequency of inspection and test to be carried out on material during and after production and instructing laboratory officer with respect to same.

### **3.3.4 Material Engineer (ME)**

- a) Reviewing and control of work instructions and forms.
- b) Identifying the type and frequency of inspection and test to be carried out on material during and after production and instructing laboratory officer with respect to same.
- c) Responsible for the timely calibration of testing machines and equipment also Reviewing equipment calibration/service record cards monthly Identifying non -conforming equipment and taking action on labeling same.
- d) Retaining brochures, manuals or other documents supplies by the manufactures of inspection testing and measuring equipment

#### **3.3.5 Site Engineer (SE)**

- a) Prepare Work schedules and detailing the subordinating staff.
- b) Delegation and instructing subcontractors for qualitative & production as per the master construction program.
- c) Responsible for the construction work with quality requirements & safety of all machinery, equipment & men at site.
- d) Checking for dimensions and accuracy of the moulds at pre- determined intervals for the compliance with the tolerance limits.
- e) Organizing and scheduling of customer / client inspection of items, which require prior approval.
- f) Joint Inspection of all works and getting the approval from the consultant/client

#### **3.3.6 Material Technician / Quality Assurance Inspector**

- a) Responsible for performing all test related in approval sources.
- b) Engaged in field testing and preparation of test reports daily.
- c) Perform frequency testing for materials as specifications.
- d) Checking for dimensions and accuracy of the formwork, reinforcement and etc., prior to concreting/ before the consultant's inspection
- e) Responsible for preparation of check lists and other quality assurance documents
- f) Preparation of monthly test summary for monthly progress report.

#### **3.3.7 Technical Officer (TO)**

- a) Attending the site Meetings and delegating / explaining to the workers the matters relating to the respective area of work.
- b) Assisting the site engineer for the execution of work & timely completion of the works.
- c) Prepare daily work plan and detailing the subordinating the staff and subcontractors.
- d) Checking dimensions, levels and accuracy of the field works before starting the work against the check list.

#### **3.3.8 Quantity Surveyor (QS)**

- a) Responsible for preparing and timely submission of monthly Interim Statements.
- b) Responsible for preparing rate break downs for new work items and unit rates in consultation with the project manager.
- c) Responsible for joint measurements of all construction.
- d) Material reconciliation for every billing period.
- e) Measurements of Sub-contracts work and certification of their works.

#### **3.3.9 CAD Draughtsman**

- a) Preparation of all existing cross section drawings.
- b) Preparation of drawings as requested by the SE.
- c) Final as built drawings.



### 3.3.10 Safety & Environmental Officer

- a) Identification of key activities and relevant EMAP areas.
- b) Preparation of EMAP.
- c) Routing checks to conform weather the issues are mitigated in the prescribed manner.
- d) Arranging training programs to develop skills of the staff.
- e) Preparation of list of obstructions such as trees / archeological monuments which are to be disturbed by the construction.
- f) Reporting of construction activities which are adversely affecting to the environment to the Project Manager & Deputy Project Manager for advising site staff.
- g) Take day to day actions to answer the short-term environmental issues and guide the relevant persons accordingly.
- h) Implement the quality control documentation procedures for all activities and maintain a filling system.
- i) Maintenance of environmental related documentations and formats.
- j) Follow the traffic management procedures introduced in the EMAP.
- k) Provide safety precautions where necessary especially at night.
- l) Make sure correct safety gears are using all the time by the works.
- m) Taking prior approval for traffic management from relevant authorities.

### 3.4 Control of Documents

- Documentation structure of the Quality Management System established at this project shall have the following arrangement
- All documents listed in the Project List of Documents shall have their revisions status, i.e., revision number and date of revision.
- Required version of each document shall be made available at point of use with a control.
- Superseded documents shall be maintained away from effective documents
- Changes done to any document shall be communicated to all parties concerned.

### 3.5 Control of work process (Method Statement) `

Process list affecting quality directly is as shown below.

Process	Control Method
Surveying work	Method statements shall be developed as necessary
Site clearance	
Earth work	
Road Pavement	
Drainage	

Culvert, Retaining Structures & Bus Bays	
--	--

The following standard method statements shall be prepared at the beginning of the project

Each will have a unique identification number

Method Statements shall be serially numbered whilst keeping the Identification unchanged upon multiple submissions

Works Type	Work method Statement Title	Code
Survey	Surveying	MO2/MS/001
Site Clearance	Clearing and Grubbing	MO2/MS/002
Earth Works	Embankment Construction	MO2/MS/003
	Road way Excavation	MO2/MS/004
	Channel Excavation	MO2/MS/005
Road Pavement	Sub Base Construction	MO2/MS/006
	Soft Shoulder Construction	MO2/MS/007
	Aggregate Base Course	MO2/MS/008
	Priming	MO2/MS/009
	Asphalt Concrete Surfacing	MO2/MS/010
Drainage, Culvert, Retaining Structures	Excavation & Back Filling	MO2/MS/011
	Cement Concrete Structures	MO2/MS/012

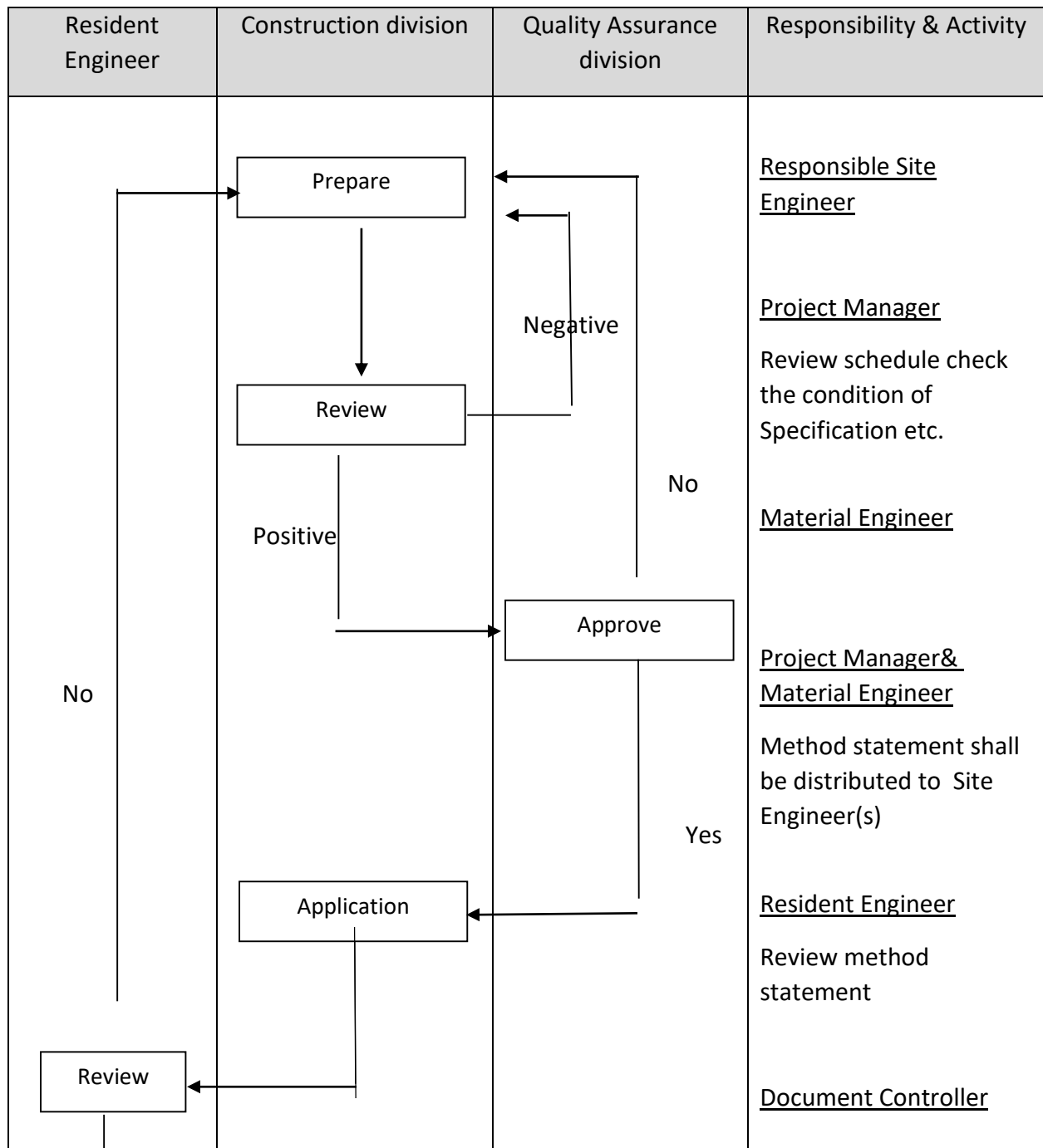
### 3.5.2 Contents of method statement

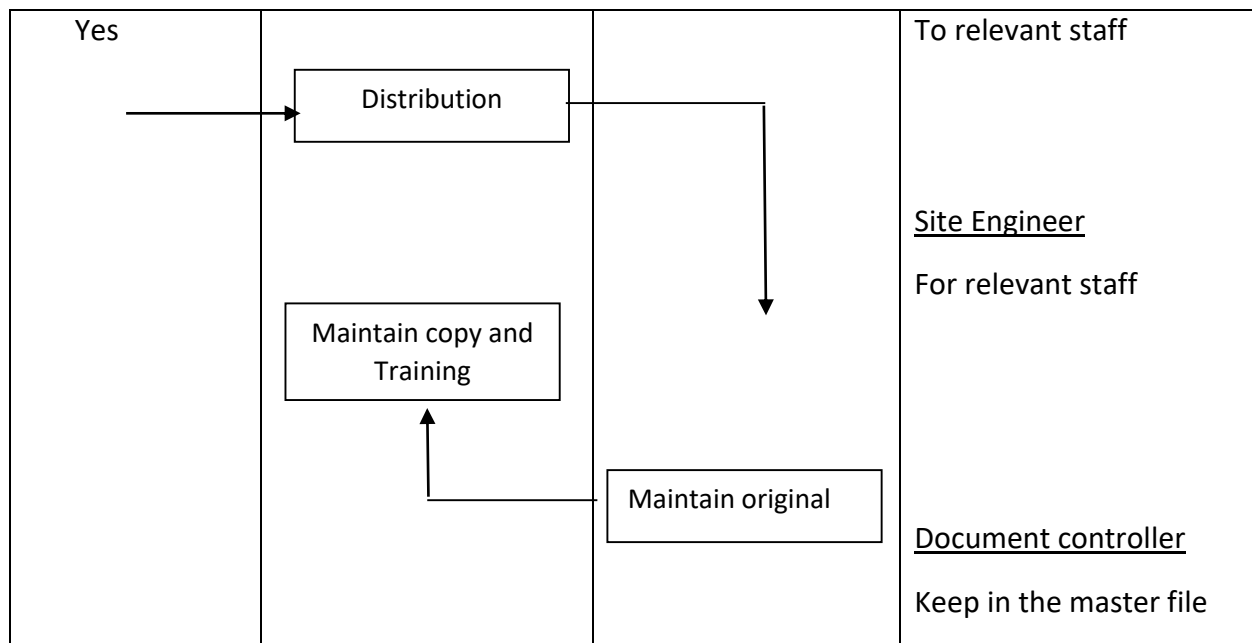
The method statement shall address the following items.

- a) Scope of work covered by the method statement
- b) Drawings and work specification
- c) Method to be used and the programme for the work
- d) Resources (Plant, labour and material)
- e) Supervision to be provided
- f) Quality system requirements
- g) Safety provisions

- h) Traffic control
- i) Check list
- j) Inspection and Test Plan

### 3.5.3 Preparation of method Statement





#### 3.5.4 Forms used for project work

Schedule of forms used for project work

1. Non- Conformance Report (NCR)
2. Request For Inspection (RFI)
3. Confirmation of Verbal Instruction (CVI)
4. Daily Work Programme (DWP)

#### 3.6 Forms Used for Internal Management Process

Schedule of internally used forms

1. Goods Received Note (GRN)
2. Stores Requisition (SR)
3. Goods Transfer Note (GTN)
4. Direct Purchase Note (DPN)
5. Stores Issued Note (SIN)
6. Gate Pass
7. Payment Voucher (Cash/Cheque)

### **3.7 Managing the Progress of the Project**

#### **3.7.1 Progress of the Project**

The work program shall be prepared by using MS Project Management Software. Progress of each construction activity will be indicated in our works program by collecting progress returns from the site at each end of the month.

Specially designed progress returning forms will be provided to the Technical and Supervising staff. The progress returns will be collected by the site in charge every day evening and handed over the Planning Engineer who monitors the progress.

#### **3.7.2 Site Progress meeting**

Regular progress meeting will be held with the suitable forum where essential two-way communication can take place between Planner and Participants. The main purpose of site progress meeting emerges, as a means of keeping a periodic check on the Project Progress and the making of any consequential decisions to implement corrective action program slippages occur or appear likely.

#### **3.7.3 Project Progress Reports**

Monthly Progress Report shall be prepared by us for internal use and submit to the Engineer. Reporting shall continue until complete all work activities of the project.

Each report shall include:

- a) Charts and detail description of progress
- b) Records of contractor's Personal and Equipment
- c) Copies of Quality Assurance documents
- d) Employer's and Contractor's claim notice
- e) Safety states, including details of accidents
- f) Comparisons of actual and planned progress
- g) Monthly weather reports
- h) Progress Photographs

### **3.8 Resource to be utilized**

The Contractor's Representative shall identify resources/requirements in the management of project and provide competent manpower for the management and performance of work. He shall base on the site, in charge of work.

### **3.9 Services and Maintenance**

The Site Engineer shall bear the responsibility of plant & Machinery or in the absence the Contractor's Representative shall assign a designated officer with sound technical knowledge to be responsible for the effectiveness and efficiency of machine in use.

The officer responsible shall maintain a service schedule and make arrangements for preventive services. He shall inspect machines on regular basis. Furthermore, he is responsible for corrective machine. He shall monitor the economics of machine.

He shall act as a coordinator between the Central workshop and Project and establish the procedure for services and maintenance.

### **3.10 Calibration of Measuring and Monitoring Devices**

The Quality Assurance Manager shall be responsible for accuracy and precision of monitoring & Measuring Devices at site.

Devices shall be calibrated as per scheduled dates in collaboration with Head Office Quality Assurance Division. Calibration schedules for articles available at site shall be obtained from Head Office and corresponding records shall be maintained.

Also, the total station and leveling instruments shall be calibrated once in six month and the same will be calibrated once the errors are found even before as mentioned in the method statement for surveying.

### **3.11 Stores Management**

A storekeeper will be appointed at the beginning of the project and his performance shall be monitored by the Project Manager. The Project Manager is responsible for communicating all instructions to him including procedures.

#### **Storage plan and Inventory Control**

Stores shall be located in a feasible, secure area with sufficient security facilities.

#### **Material receiving, Storage and Issues**

All articles shall be inspected upon receipt by Store Keeper and Bin Cards and Inventories are used to maintain records.

#### **Reports- over, short, damaged supplies**

The sender shall be informed immediately if supply is different from the required amount.

#### **Disposal of surplus material**

Approval shall be obtained from authorities as per the company procedure for stores Management.

#### Customer property

Material belong to Customer shall be stored in a storage area demarcated with “Customer Property” and records of such shall be maintained in Customer Property Register and in BIN cards by the storekeeper.

The items would be checked specially for the over, short and damage supplies at the time of receipt.

#### **3.12 Internal Auditing**

Implementation of the Quality Management System at the project level will be audited once in every 6 months period by a team of internal auditors.

Corrective Action Requests shall be raised once a procedural non-conformance is detected.

Project Manager shall ensure that all required action is being taken to eliminate the cause of the non- conformance.

Records of Audit shall be maintained in a separate folder.

## **Chapter 4**

### **PROJECT QUALITY ASSURANCE SYSTEM**

#### **4.1 Introduction**

The Quality Assurance System describes the planning and accomplishment of activities affecting quality under suitable controlled condition. Quality Assurance Manager and the Quality Assurance Inspector shall audit and review the work quality of the project to make sure that all efforts are performed in the manner established by the quality system and particulars.

The Quality Assurance Manager shall report to the Project Manager directly. The Quality Assurance Manager shall be the person with the authorities and responsibilities identified as the Quality Assurance Management Representative.

The Quality Management System (QMS) shall be established, implemented & maintained at the Road project by .....Ltd as per this document in accordance with ISO 9001:2015.

Quality of outsourced product & Services shall be measured upon confirmation. Continuity of the provided quality shall be monitored throughout the project by means of

- Inspection & Testing.
- Internal QMS Audits.
- Supplier Evaluations according to standard criteria.
- Sub-contractor Evaluations according to standard criteria.

#### **4.2 Management Commitment**

The top management of .....Ltd is committed to implement, maintain and improve the Quality Program at project.

The top management including Project Manager shall be aware of the related regulatory and statutory requirements for the contract and communicate to employees.

Make employees aware of project requirements including time constrain, quality and other parameters.

Analyze the technical and non-technical problems and potential problems arisen ensure the availability of resources to meet the above-mentioned requirements.

Establish Quality Objectives in consultation with company Management Representative/ISO Coordinator which shall be revised once achieved.

Periodically review the effectiveness of the QMS



### **4.3 Customer Focus**

Top Management of .....Ltd ensures that,

- The requirements stipulated in the contract document and specifications are met.
- The project is completed within the time allocation.
- The complaints made by client or any other stakeholder are promptly responded and feedback obtained.
- Records of such shall be maintained at site as per record control procedure

### **4.4 Control of Inspection and Testing**

The required inspection and testing shall be established and implemented in accordance with Work Method Statements.

The Project Manager and Quality Assurance Manager shall ensure that both off-site and on-site inspection and tests are carried out, recorded and reported;

- a) on receipt of material
- b) at all stages of the work in accordance with Inspection & Test plans and specified test frequencies.

In accordance with approved work method statement before further work is allowed to proceed. Non-conforming items and activities shall be reported to the responsible Site Engineers as per the non-conformance procedure.

The site manager and the Quality Assurance Manager shall ensure that samples are taken and tests are carried out in accordance with the approved Quality Manual and the results are recorded.

On-site testing shall be carried out in accordance with the requirements of the contract Specifications. The specified tests must be provided on Inspection & Test Plan (ITP).

ITP shall be prepared based upon the requirements on Specifications, drawings, procedures, applicable codes and Standards.

ITP shall be prepared to check and ensure minimum of activities to be performed, acceptance criteria by which activities are performed, and the sequence in which the activities are to be performed.

### **4.5 Control of inspection, Measuring and Test equipment**

The Site Engineer and Quality Assurance Manager shall ensure

- a) Surveying and setting out instruments and Tapes.
- b) Volume measuring devices.

- c) Material test equipment, are correctly selected and that site staff maintain and use them correctly.

Site staff will maintain separate calibration record sheets for each item of equipment including calibration frequency. Record sheets and labels on each item of equipment will identify the equipment and show when the next calibration is due.

Calibration will be carried out in accordance with the relevant Quality System Procedure.

Calibration records shall be followed under the quality procedure.

Responsible staff for equipment control and maintenance

Equipment Type	Responsible
Laboratory	Quality Assurance Manager (QAM)
Surveying	Site Engineer/Surveyor

#### 4.6 Control of Non- Conforming Product

##### 4.6.1 Responsibilities

All items which do not confirm to the specified requirements for construction, products and material are described in detail on the Non-Conformance Product control and Review procedure.

QA Manager is responsible for the following:

- ◆ Evaluating NCRs for non-conformance trends and repetition.
- ◆ Issue CAR (if necessary)
- ◆ To verify and close out NCR with the approval of RE (if necessary)
- ◆ To review proposed disposition (rectification).

Quality Assurance Inspector (QAI) is responsible for the following:

- ◆ To immediately initiate an NCR (if necessary, with marking) on non-conforming item/material/work.
- ◆ To review and verify all the disposition (rectification) activities of non-conformance

Site Engineer is responsible for the following:

- ◆ To provide the proposed disposition and technical justification, as applicable and proposed corrective action.

- ◆ Completing applicable points of the NCR and relating the NCR in accordance with the flow chart of this procedure.

#### 4.6.2 Definition

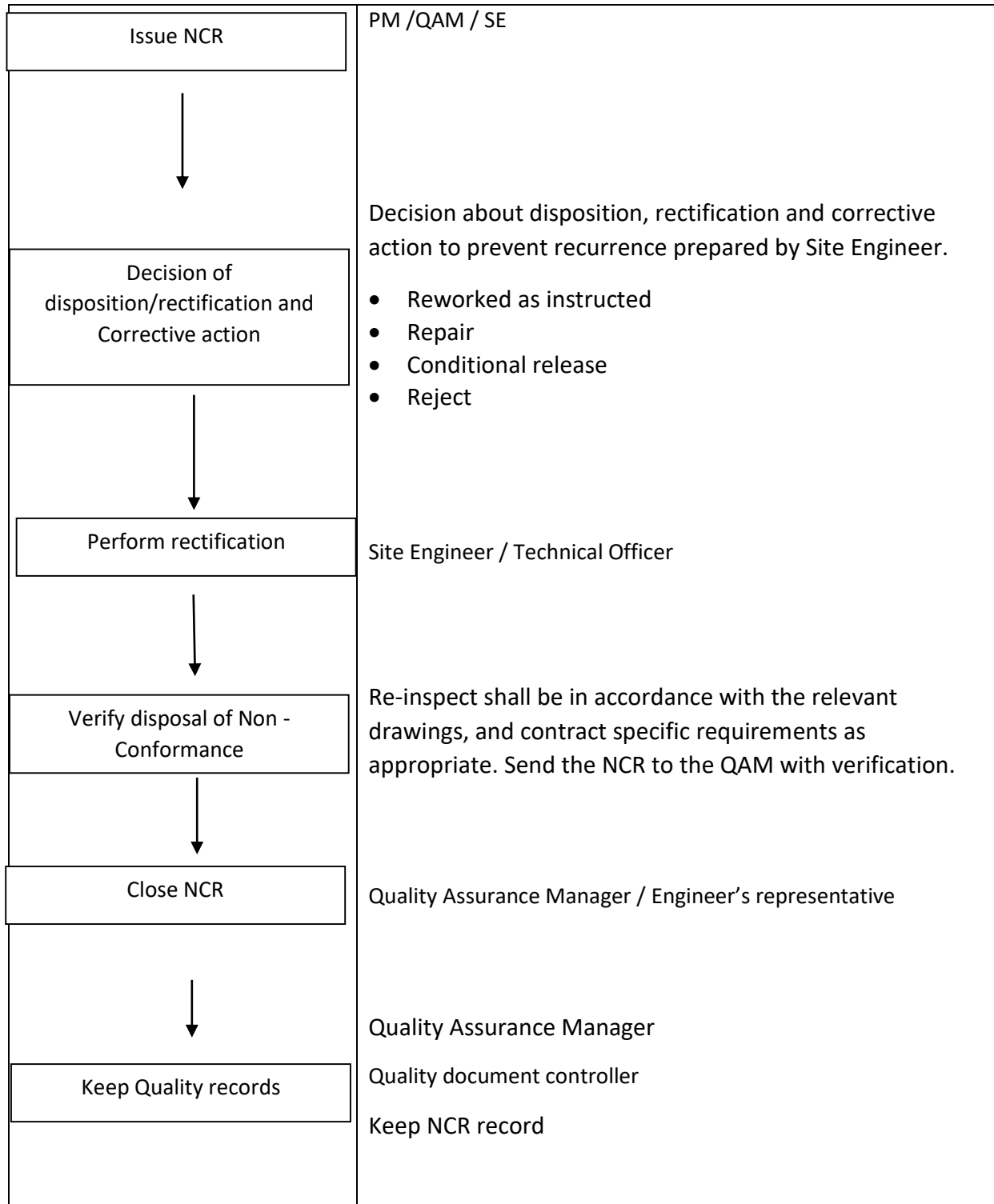
- Non-conformance - A deficiency in characteristic, documentation, or procedure that does not confirm to the contract requirement.
- Marking - A marking which is used for identifying the part and extent of defect of a certain non-conforming item / material.
- Repair - The process of physically restoring a non-conformance to a condition such that item/material/work complies with the requirements of the contract.
- Rejected - The disposition which indicates that the non-conforming item/materials cannot be used for the assigned purpose of function.
- Re-work - Non-conforming process shall be preceded to meet the special requirements, as contained in NCR approval.
- Conditional Release - Process can be continued conditionally when it will not affect the next process.

#### 4.6.3 Control of non-conformance

Once a decision has been made and any necessary approval or instruction of RE has been received, the responsible site Engineer will ensure the non-conforming work is remedied accordingly and that re-inspections and re-tests are notified to the QA Manager and RE.

#### 4.6.4 Flow chart for internally generated NCR

Sequence	Responsible & Activity
	All employees
Finding a Non-Conformance	All employees of the project organization are required to notify their superiors as per organization chart of any non-conforming product, known to them.
↓	Quality Assurance Inspector
Marking (immediately)	Quality Assurance Inspector
↓	Using the NCR form, NCR no. shall be registered in the non- conformance report log is the document controller.



## **Annexure – 2 - Method Statement**

## METHOD STATEMENT

This Method Statement consists of methods of carrying out all works. Normally major works are given in separate chapters as follows

1. Survey works
2. Site clearing
3. Roadway excavation
4. Structure construction
5. Embankment filling
6. Sub base filling
7. ABC works
8. Prime coat
9. Soft shoulder
10. Asphalt paving
11. Slope protection
12. Road furniture and road marking

### 1. SURVEY WORKS

#### 1.1. General

This Method Statement covers the TBM Survey Center Line Setting out, Center Line marking, Cross Section Survey and Submitted of cross section drawings.

#### 1.2. Reference

Particular specification Section 117

#### 1.3. Resources

##### 1.3.1. Material

No.	Material	Quantity
1	Road Marking Paint	As required
2	Concrete Nails	As required
3	Concrete	As required

##### 1.3.2. Equipment

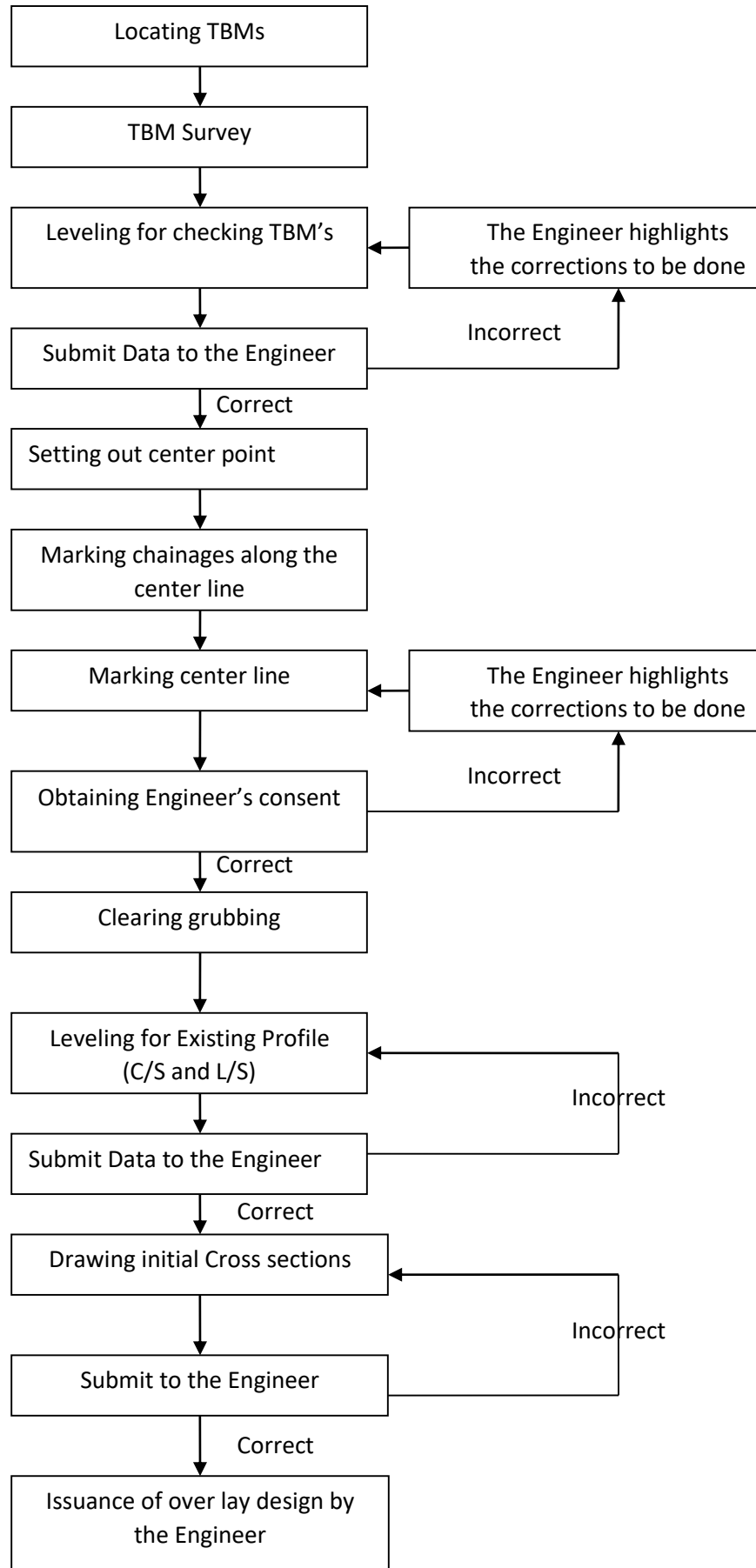
No.	Equipment	Quantity
1	Total Station, complete with tripod, optical plummet and other accessories	01
2	Target prisms with mounting poles, Leveling bubbles etc.	02

3	Survey Leveling Staff, four meter long	04
4	Automatic level, complete with tripod and other accessories	02
5	Targets with carrying case	02
6	Steel tape (30m)	02
7	Steel tape (5m)	05
8	Brass plumb	02
9	Hammer, 2 kg weight	01
10	Axe	01
11	Mamoty	01
12	Surveyor umbrella, large	02
13	Pegs and stakes	as required
14	Traffic Cone	06
15	Rope (50m Length)	01
16	Safety Sign Board	08

### 1.3.3. Manpower

No.	Job Title	Quantity
1	Site Engineers	01
2	Surveyors	01
3	Technical Officer	02
4	Auto cad draft person	01
5	Skill Laborers	04
6	Flagmen	02

#### 1.4. Flowchart





## 1.5. Sequence of Survey Work

### 1.5.1. Calibration

#### (a) Level Instrument

Calibration of the level instrument is carried out regularly at every six months and two peg level tests on the leveling instrument would be carried out once in a month and if we would find any error in instrument during working, immediately we would be attending to the calibration of the instrument.

#### (b) Total Station

Once in an every six month period, the calibration would be carried out until the project end in accordance with relevant standards and if we would find any defect in instrument during working, immediately we would be attending to the calibration of the instrument by an instrument repair institute.

### 1.5.2. TBM Survey

Initially the Engineer's/Employer's concurrence will be sought to obtain if any details of permanent bench marks tied with national grid. At least four Temporary Bench Marks (TBM) / Reference Control Points (RCP) shall be established within each kilometer length of road. Additional TBMs / RCPs shall be located where work is required to be carried out on structures such as bridges and culvert. Coordinates of all TBMs shall be taken by using total station and levels by using automatic level. List of TBMs / RCPs and their levels and coordinates would be submitted to the Engineer for the approval. All TBMs / RCPs shall be maintained and safeguarded during the construction period. Checks would be carried out on these bench marks once in every month and adjustments if any should be agreed with the Engineer. An up-to-date record of all bench marks including approved adjustments would be maintained with the Engineer.

### 1.5.3. Center Line Setting out and Marking

Centre points of the existing road shall be established at every 10m interval on the road as closely as practicable in coordination with the Engineer or otherwise. Chainages would be marked on the road center line in each 10m and 100m interval and kilometer interval respectively. Coordinates and levels at every 10m interval of the center line of the road shall be taken by using the total station and submitted to the Engineer for comments / acceptance.

With the aid of rope and road marking paint, the center point marked in every 10m intervals of the road would be extended as a center line. At this stage any minor changes found necessary to the existing horizontal and vertical profile shall be examined and verified in coordination with the Engineer. All working drawings will be

submitted accordingly and the established approved center line would be maintained until the end of the project.

#### 1.5.4. Correction

According to the Engineer's instructions, corrections if any would be made and which would be followed for the remaining work.

#### 1.5.5. Clearing and grubbing

All clearing and grubbing works that are required to be done along the road shall be completed prior to the longitudinal and cross section surveys or as directed by the Engineer.

#### 1.5.6. Cross Section Survey

The cross-section survey would be commenced and continued up to 5m beyond the existing right-of-way on either side, for both sides of the road as soon as center line is marked and approved by the Engineer. At the same time, for plotting of longitudinal section (LS) the center value of each cross section would be used. Based on the established centerline, cross section survey shall be done at 10m intervals or at such other closer interval along the road as directed by the Engineer.

#### 1.5.7. Submittal of Drawings

Prepared initial drawings of the longitudinal profile and cross sections plotted on A<sub>4</sub> sheets (both hard and soft copy), shall be submitted to the Engineer along with back up data sheets for verification and approval.

#### 1.5.8. Traffic control and safety provision

Two flagmen shall be assigned on either ends of the working area or warning signs shall be displayed in advance at site to facilitate the traffic in one way where required. Working area shall be barricaded with warning tapes and painted barricades or by placing traffic cones. Safety jackets are provided to all staff, workers and flagmen.

## 2. SITE CLEARING

### 2.1. General

This work shall consist of clearing, grubbing, removing and disposing of everything on the ground surface within the right of way, including bushes, trees and all other vegetation and debris, except all objects, trees and other vegetation that are designated to remain.

## Reference

- Particular Specification Section 6.2
- Standard Specifications for Construction and maintenance of road and bridges, 2<sup>nd</sup> Edition June 2009, published by the ICTAD (SCA/5)
- Contract Drawings
- Construction Drawings

## 2.2. Resources

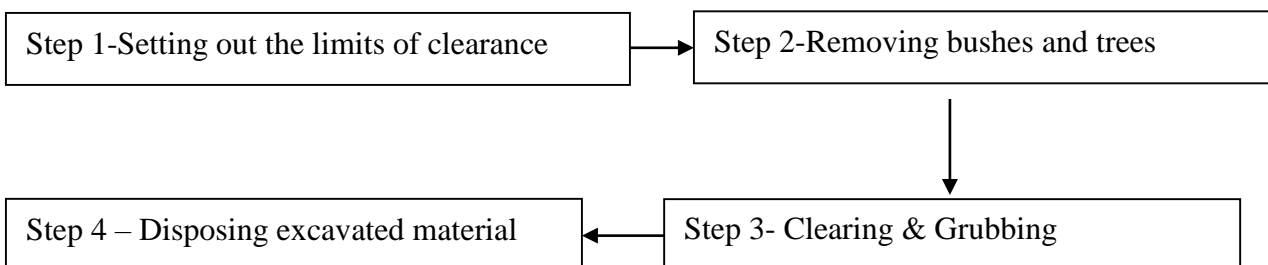
### 2.2.1. Equipment

No	Equipment	Qty
1	Motor Grader	1
2	Backhoe Loader	1
3	Dump Truck/Tippers	1
4	Farm Tractor	1

### 2.2.2. Manpower

No	Job Title	Qty
1	Site Engineer	1
2	Supervisor	1
2	Operator	2
3	H/V Driver	3
4	Labourer	5

## 2.3. Flow Chat



#### 2.4. Sequence of work

- Step 1 The limits of clearing or clearing & grubbing shall be set out according to the construction limits shown in the construction drawings, using the pegs in suitable intervals.
- Step 2 Trees and stumps shall be removed without damaging adjoining property, existing road way and other facilities, utilities and services, trees and plants designated for preservation. The stacked, saleable timber shall be handed over to the appropriate Government authority concerned with the approval of the Engineer and the Employer. Unsaleable timber and all stumps, roots, logs and other refuse from the clearing and grubbing operation shall be disposed of by burning or other means.
- Step 3 Clearing and Grubbing shall be done up to the limits established using motor grader/ Backhoe loader. Sections where the motor grader can't reach shall be cleared manually. In areas where the embankment construction is required the topsoil shall be removed to an average depth of 0.15m. (Top soil removing describes under embankment construction) Cleared material shall be disposed to the selected locations out of the site. Material loading shall be done using backhoe loader and disposing shall be done using dump trucks or farm tractors.
- Step 4 Initially suitable dumping sites are selected in accordance with environmental aspects and consent letters by the owners are collected. Then those sites are forward to ARE & RE along with the land owners' letters for their approval. After receiving the approval, the same is forward to the Pradeshia Sabha for their approval. The excavated material is dumped to those sites with the help of a loader and a tractor or truck.

#### 2.5. Supervision

Position	Responsibilities
Site Engineer	Responsible for execution of works according to the Method Statement
Technical officer/Supervisor	All setting out works in accordance with Method Statement
Foreman	Assist to Site Engineer

#### 2.6. Inspection

According to the attached Inspection & Test Plan, inspection and tests shall be notified to Site Engineer (SE). Site Engineer shall inspect site works as scheduled and report the check list to QAM/QAI.

The Inspection and Test Plan for relevant working area shall be available on site for the Engineer to see. Upon completion of the Inspection and Test Plan, the ITP shall be maintained at the Company project office and submit to the Engineer with the progress claim.

## 2.7. Traffic Control

Two flagmen shall be assigned on either end of the working area. One traffic warden shall be assigned at loading point to guide the dump truck when turning and reversing.

## 2.8. Safety Provision.

- Warning signs shall be displayed in advance and working area.
- Safety briefing for drivers on defensive driving.

## 2.9. Attached Forms.

2.9.1. Check list

2.9.2. Inspection and Test Plan.

# 3. ROADWAY EXCAVATION

## 3.1. General

This work shall consist of reducing high sides of the road especially in hilly areas in order to get the space for necessary widening of the road.

## 3.2. Reference

- Particular Specification Section 6.2
- Standard Specifications for Construction and maintenance of road and bridges, 2<sup>nd</sup> Edition June 2009, published by the ICTAD (SCA/5)
- Contract Drawings
- Construction Drawings

## 3.3. Resources

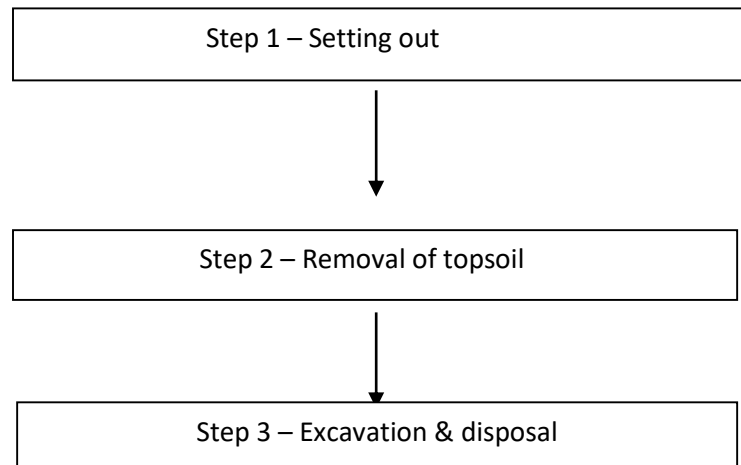
### 3.3.1. Equipment / Machinery

No.	Equipment/Machinery	Q'ty
1	Excavator	1
2	Backhoe Loader	1
3	Drum Trucks / Farm Tractors	As required
4	Survey Equipment	As required

### 3.3.2. Manpower

No.	Job Title	Qty
1	Engineer / Technical officer	1
2	Surveyor	1
3	Laboratory Technician	1
4	Supervisor	1
5	Operator	2
6	Heavy Vehicle Drivers	As required
7	Labourers	7

### 3.4. Flow Chart



### 3.5. Sequence of Roadway Excavation.

#### Step 1 Setting out the limits of Roadway Excavation

After the completion of initial cross surveying & design of road formation levels & limits of the road corridor where the roadway excavation is required, pegs shall be fixed at a suitable distance outside the actual limit of road way excavation (as per construction drawing or as directed).

## **Step 2 Removal of topsoil.**

Prior to removal of top soil at any chainage of the road, Site Engineer or Technical Officer shall identify if there is any existing crops or structure within the area that require the attention of the Engineer. If there is any, Contractor Reps shall inform the consultants for further instructions. Topsoil shall be removed to an average depth of 0.15 m from the original surface using excavator / backhoe loader within the limits of roadway excavation. Where the motor grader / backhoe loader can't be used, top soil shall be removed manually. Excavated top soil shall be removed from the site to approved disposal yard to stock piled for later usage ( if necessary ) at the designated stock yard area using backhoe loader or excavator and dump trucks or farm tractors.

## **Step 3 Excavation & disposal**

Prior to excavation, the soil sample shall be tested (initially visually then laboratorial if stable) for their suitability to be used as a construction material (material for construction of embankment or shoulder). If the materials are suitable, it shall be stock piled at the designated locations otherwise disposed as top soil.

### **3.6. Supervision**

<b>Position</b>	<b>Responsibilities</b>
Site Engineer / Technical Officer	Perform the embankment construction basis of method statement & specification.
Surveyor	All setting out works in accordance with Method Statement and drawings / Engineer's instructions.
Laboratory Technician	Carrying out relevant field tests
Supervisor	Work supervision

### **3.7. Inspection**

According to the attached Inspection and Test Plan, inspection and tests shall be notified to Site Engineer / Technical Officer. Site Engineer / Technical Officer shall inspect site works as scheduled and report the check list to QAM/QAI & he shall be notified to Construction Engineer (CE) as required.

The Inspection and Test Plan for relevant working area shall be available on site for the Consultants to see. Upon completion of the Inspection and Test Plan, the ITP shall be

maintained at the Company Project Office and submitted to the Engineer [& a copy with the progress claim].

### **3.8. Traffic Control**

Two flagmen shall be assigned on either side of the working area. One traffic warden shall be assigned at unloading point to guide the dump truck when turning, reversing & unloading.

### **3.9. Safety Provision**

Warning sign shall be displayed in advance & working area. Accident prone areas if any shall be barricaded with barricading tapes or by placing painted barrels. Traffic warden jackets shall be provided to all flagmen. Safety briefing shall be provided for drivers on defensive driving

### **3.10. Attached Forms**

3.10.1. Check List

3.10.2. Inspection and Test Plan

## **4. STRUCTURE CONSTRUCTION**

### **4.1. General**

This work shall consist of the necessary excavation & backfilling for foundations of bridges, culverts, retaining walls, head walls, wing walls, line drains and other structures and also disposal of all excavated unsuitable material, shaping and finishing all earth work involved in conformity with the required alignment, levels, grades and cross sections as shown in the drawing. Then formwork fixing steel r/f fixing, concrete placing, curing, removal of formworks and surface corrections, any honey combs to be repaired after showing to the Engineer 's representative

### **4.2. Reference**

- Particular Specification Section 6.2
- Standard Specifications for Construction and maintenance of road and bridges, 2nd Edition June 2009, published by the ICTAD (SCA/5)
- Contract Drawings
- Construction Drawings



#### 4.3. Resources

##### 4.3.1. Material

No.	Material	Specification
1	Type I embankment material	Sub section 302 of Standard Specifications
2	Type II embankment material	Sub section 302 of Standard Specifications
3	Sub base material	Sub Section 400 of Standard Specifications
4	Aggregate Base Course	Sub Section 405 of Standard Specifications
5	Crushed aggregate filter	Sub section 705 of Standard Specifications.
6	Formwork and supports	
7	Correctly fabricated steel	
8	Water for curing and protection material such as gunny bags	

##### 4.3.2. Equipment/ Machinery (one unit)

No.	Equipment/Machinery	Qty
1	Backhoe Loader	1
2	Tipper / Farm tractor	1
3	Water Bowser	1
4	Rammer	1
5	1 Ton Roller	1
6	Field density kit	One set
7	Concrete transit mixers	02
8	Immersion vibrators	To suit the requirement for the day's work
9	Hand shovels etc.	

#### 4.3.3. Manpower (One unit)

No.	Job Title	Qty
1	TO/Supervisor	1
2	Labourer	8
3	Lab Technician	1
4	Laboratory Helpers	2
5	operators	To suit the requirement for the day's work

#### 4.4. Sequence of work.

##### Step 1 Preparation

Prior to commencement of excavation, the limits of excavation shall be set out as shown in drawings by using timber pegs & string. The depth of excavation shall be as shown in the drawings or as directed by the Engineer. If it is necessary, exposed surface of excavation shall be protected by erecting all necessary shoring shuttering or timber planking. Prior to commencement of backfilling all loose material and any debris shall be removed from the area to be backfilled. The bottom of the area to be backfilled shall be leveled and compacted to get even surface.

Step 2 Screed concrete shall be placed on hard polythene laid on the base or well compacted and slightly moistened earth surface. If water table is found at bed level it should be lowered by a pump operating with the suction hose in a nearby pit. The base should be covered with stones spread, so that the screed will not mix with the muddy soil.

Step 3. When the screed is hardened for 3 days R/f fixing and form work fixing will follow as per the approved construction drawings. Care should be taken to have the necessary concrete cover. Form work should be sturdy enough to stand the pressure of wet concrete and the men standing on it while pouring concrete. Specification requirements should be strictly observed. Care should be taken in fixing formworks such that the panels can be removed easily without damaging the components. An experienced foreman should supervise the work.

##### Step 4 Backfilling and Compaction of Material.

Backfilling shall be commenced after 7 days of construction of the concrete or masonry work. The layer thickness shall be marked on the surface of the concrete on fill side so that the thickness control is ensured and the engineer's representative can make note of it and there will be no disagreements.

Approved embankment type 1 and type 2 material from borrow pits shall be transported and placed in layer not exceeding 225mm loose thickness if excavated material is not conforming properties of type 1 and type 2 material. Excavated material shall be used for backfilling if the material is confirmed with the specification. Material shall be spread by backhoe loader in larger areas and manually in small areas. The material shall be compacted using rammer/ 1 ton roller. After the specified degree of compaction is achieved in previous layer the successive layer shall be placed. This process shall be preceded up to the top of type 1 embankment material layer. The thickness of the type 1 material layer shall be 150mm. A 200mm thick compacted sub base material and 150mm thick compacted aggregate base course material shall be placed on the top of type 1 material depend on the position of the backfill.

The field density tests shall be carried out in every fill layer to find out the degree of compaction as follows.

- The aggregate base course layer shall be compacted to a density not less than 98% of the Maximum Dry Density of the material as determined by BS 1377, test 13 (Heavy) or AASHTO T-180 (modified)
- The sub base layer shall be compacted to a density not less than 98% of the Maximum Dry Density of the material as determined by BS 1377 test 13 (modified) or AASHTO T-180.
- The embankment layers shall be compacted to a density not less than 95% of the Maximum Dry Density of the material as determined by BS 1377, test 13 or AASHTO T-180.
- The field moisture content shall be determined by drying out the test pit sample using a gas burner.

#### 4.5. Supervision

Position	Responsibilities
Site Engineer	Perform the backfilling on the basis of method statement and specifications
Technical Officer	All setting out works in accordance with Method Statement and drawings
Supervisor	Assist to Site Engineer/ Technical officer
Laboratory Technician	Carrying out of relevant tests in accordance with method statement

#### 4.6. Inspection

According to the attached Inspection and Test Plan (ITP) “H” point, “W” point inspection and tests shall be notified to Site Engineer. Site Engineer shall inspect site works as scheduled and report the Check List to QAM/QCI.

The Inspection and Test Plan for relevant working area shall be available on site for the Engineer to see. Upon completion of the Inspection and Test Plan, the ITP shall be maintained at the Company Project Office and submit to the Engineer with the progress claim or as agreed.

#### 4.7. Safety Provision

Warning signs shall be displayed in advance as well as in working area. Working area shall be barricaded with barricading tapes with painted barrels or by placing traffic cones. Traffic warden jackets are to be provided to all flagmen. When a road section is closed at night blinker lights shall be provided at both sides.

#### 4.8. Attached Forms

4.8.1. Check List

4.8.2. Inspection and Test Plan

### 4.9. EMBANKMENT FILLING

#### 4.9. General.

This work shall consist of supplying, laying and compacting approved Type I and Type II material in layers on a prepared sub grade for widening section or new sections of road.

#### 4.10. Reference

- Particular Specification Section 6.2
- Standard Specifications for Construction and maintenance of road and bridges, 2<sup>nd</sup> Edition June 2009, published by the ICTAD (SCA/5)
- Contract Drawings
- Construction Drawings.

#### 4.11. Resources.

##### 4.11.1. Material

No.	Material	Specification.
1.	Embankment fill material (Type I and Type II)	Clause 304 of sub section standard specification,

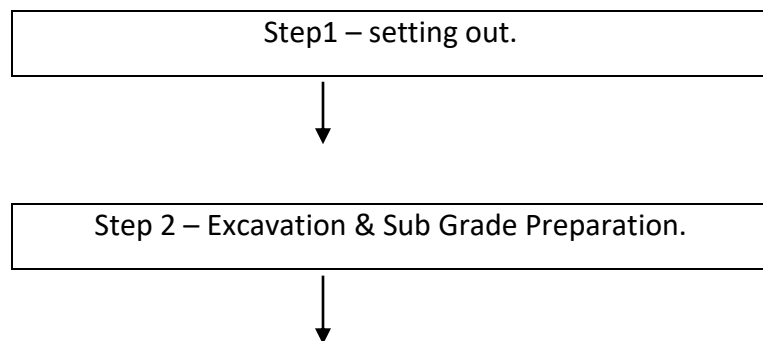
4.11.2. Equipment/ Machinery (One unit).

No.	Equipment/ Machinery.	Qty
1.	Backhoe Loader/ Skid Loader	1
2.	Dump Trucks/ Trippers.	As required.
3.	1 ton Roller/ 4 ton roller/8 ton roller [depending on width of fill]	1
4.	Rammers.	2
5.	Motor Grader.	1
6.	Water Bowser	1
7.	Soil Testing Equipment	one set

4.11.3. Manpower (One unit).

No.	Job Title	Qty
1.	Technical Officer	1
2.	Supervisor	1
3.	Laboratory Technician	1
4.	Laboratory Helpers	2
5.	Flagmen	2
7.	Labourers	6

4.12. **Flow Chart.**



**Step 3 – Placing and compaction of Emb. fill Material.**

**4.13. Sequence of Edge treatment and/or widening.**

**Step1 Setting out.**

The edge of the road shall be marked by fixing timber pegs at every 20m intervals (or in curved section 10m/5 m intervals as directed by the Engineer) and strings. The width to be excavated shall be marked on the pegs according to the construction drawings.

**Step2 Excavation & sub grade preparation.**

Filling shall be carried out to the lines & levels marked on pegs Excavated soil shall be removed from the site to disposal yards using backhoe loader and dump trucks or farm tractors. The exposed surface shall be trimmed and leveled manually or by machine depending on the width available, and compacted using rammers or 1 ton /4 ton /or bigger rollers to suit the site requirements. The field density test shall be carried out on prepared sub grade. Before filling the sub base, the sub grade shall be suitably moistened as required. The exposed surface shall be compacted to a density not less than 95% of the Maximum Dry Density of the material as at a moisture content within 2% of the optimum moisture content as determined by BS1377 part 4 1990, method using 4.5kg hammer test 13 (Modified Proctor). The top of the sub grade on which base or sub base or fill material is to be placed shall be trimmed, prepared and compacted to minimum depth of 0.15m to not less than 93% of maximum dry density as determined by BS1377 part 4 1990, method using 4.5kg hammer test 13 (Modified Proctor).

**Step3 Placing and Compaction of Embankment fill material.**

The construction of embankment fill in any section of the works shall be commenced after the drainage works in that section have been made satisfactory. When this is not practicable, temporary cross drains shall be provided to suitably drain the sub grade. Immediately prior to spreading of fill material, the sub grade that has already been prepared shall be cleared of any extraneous matter and the surface shall be suitably moistened. The already approved material from stock piles shall be transported, placed, evenly spread over the whole of the designated area for the layer concerned and compacted. Material shall be spread by manually/skid loader in small sections and by backhoe loader/motor grader in large sections. If required, material shall be near the optimum moisture content  $\pm 2\%$  (OMC). Oversize material, rock pieces or

lumps of size more than 50mm or half the layer thickness shall be removed. The thickness of each layer shall be determined according to the full thickness of the sub base to be laid. Normally the loose thickness of a layer shall be between 125mm to 225mm. The material shall be compacted with 8 ton / 4 ton/1 ton roller in wider sections and rammers in strips. Rolling shall be commenced at the edge and proceed towards the center except the super elevation sections. The layers shall be compacted to not less than 95% and 90% of the maximum dry density respectively of the material as determined by BS 1377, test 13 (Modified Proctor) as per specification depending on the depth of fill. Where the fill is more than one layer the layers to follow shall be placed only after the degree of compaction of the previous layer has been tested and found satisfactory. This process shall proceed up to the bottom level of sub base course that is shown in the construction drawings. The field density tests shall be carried out on every layer.

**4.14. Supervision.**

Position	Responsibilities.
Site Engineer	Perform the edge treatment and/or widening on the basis of method statement, specification & construction drawings
Technical Officer	All setting out works in accordance with Method statement and drawings.
Foreman	Assist to Site Engineer/Technical officer.
Laboratory Technician	Carrying out relevant field tests.

**4.15. Inspection.**

According to the attached Inspection & Test Plan “H” point “W” point inspection and tests shall be notified to Site Engineer. Site Engineer shall inspect site works as scheduled and report the checklist to QAM/QAI.

The inspection and Test Plan for relevant working area shall be available on site for the Engineer to see. Upon completion of the Inspection and Test Plan, the ITP shall be maintained at the company project office and submit to the Engineer with the progress claim

#### 4.16. Traffic Control.

One traffic warden shall be assigned at unloading point to guide the dump truck when turning, reversing and unloading. Two flagmen shall be assigned on either side of the working area if the available space is narrow for traffic.

#### 4.17. Safety Provision.

Warning signs shall be displayed in advance as well as in working area. Excavated area shall be barricaded with barricading tapes or by placing traffic cones. Traffic warden jackets to be provided to all flagmen, Safety briefing for drivers on defensive driving.

#### 4.18. Attached Forms.

4.18.1. Check List.

4.18.2. Inspection and Test Plan.

### 5. SUB BASE FILLING

#### 5.1. General.

This work shall consist of supplying, laying and compacting approved upper sub base and lower sub-base material in layers on a prepared sub grade for widening section or existing road.

#### 5.2. Reference

- Particular Specification Section 6.2
- Standard Specifications for Construction and maintenance of road and bridges, 2<sup>nd</sup> Edition June 2009, published by the ICTAD (SCA/5)
- Contract Drawings
- Construction Drawings.

#### 5.3. Resources

##### 5.3.1. Material

No.	Material	Specification.
1.	Sub base material (upper sub base and lower sub base)	Clause 401 of sub section standard specification,



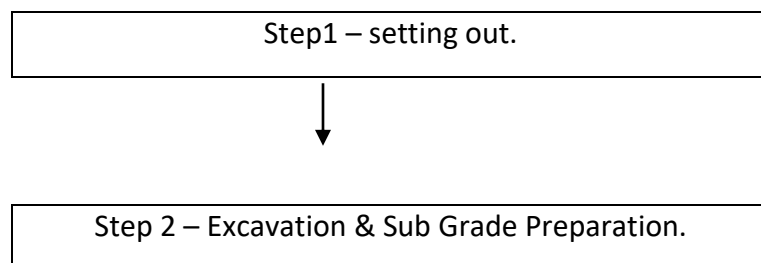
#### 5.3.2. Equipment/ Machinery (One unit).

No.	Equipment/ Machinery.	Qty
1.	Backhoe Loader/ Skid Loader	1
2.	Dump Trucks/ Trippers.	As required.
3.	1 ton Roller/ 4- ton roller	1
4.	Rammers.	2
5.	Motor Grader.	1
6.	Water Bowser	1
7.	Soil Testing Equipment	one set

#### 5.3.3. Manpower (One unit).

No.	Job Title	Qty
1.	Site Engineer/ Technical Officer	1
2.	Supervisor	1
3.	Laboratory Technician	1
4.	Laboratory Helpers	2
5.	Flagmen	2
6.	Heavy Vehicle Driver	As req.
7.	Labourers	8

#### 5.4. Flow Chart.





Step 3 – Placing and compaction of sub base Material.

**5.5. Sequence of Edge treatment and/or widening.**

**Step1 Setting out.**

The edge of the road shall be marked by fixing timber pegs at every 20m intervals (or in curved section 10m / 5m intervals) and strings. The depth to be excavated shall be marked on the pegs according to the design drawings.

**Step2 Excavation & sub grade preparation.**

Excavation shall be carried out to the lines & levels marked on pegs manually or by Loader backhoe. Excavated soil shall be removed from the site to disposal yards using backhoe loader and dump trucks or farm tractors. The exposed surface shall be trimmed and leveled manually and compacted using rammers or 1 ton / 4 ton / 8 - ton rollers to suit the site requirements. The field density test shall be carried out on prepared sub grade. Before filling the sub base, the sub grade shall be suitably moistened as required. The exposed surface shall be compacted to a density not less than 95% of the Maximum Dry Density of the material as at a moisture content within 2% of the optimum moisture content as determined by BS1377 part 4 1990, method using 4.5kg hammer test 13 (Modified Proctor). Except where top of sub grade compaction is required in an excavation of less than 1200mm in width in which case, the top of the sub grade on which base or sub base or fill material is to be placed shall be trimmed, prepared and compacted to minimum depth of 0.15m to not less than 93% of maximum dry density as determined by BS1377 part 4 1990, method using 4.5kg hammer test 13 (Modified Proctor).

**Step3 Placing and Compaction of Sub base material.**

The construction of sub-base in any section of the works shall be commenced after the drainage works in that section have been completed. When this is not practicable, temporary cross drains shall be provided to suitably drain the sub grade. Immediately prior to spreading of sub-base material, the sub grade that has already been prepared shall be cleared of any extraneous matter and the surface shall be suitably moistened. The already approved sub base material from borrow pits shall be transported, placed, evenly spread over the whole of the designated area for the layer concerned and compacted. Material shall be

spread by manually/skid loader in small sections and by backhoe loader/motor grader in large sections. If required, material shall be sufficiently wet or dry up at or near the optimum moisture content (OMC). Oversize material, rock pieces or lumps of size more than 100mm or half the layer thickness shall be removed. The thickness of each layer shall be determined according to the full thickness of the sub base to be laid. Normally the loose thickness of a layer shall be between 125mm to 225mm. The material shall be compacted with 4ton/1ton roller in wider sections and rammers in strips. Rolling shall be commenced at the edge and proceed towards the center except the super elevation sections. The upper sub- base and lower sub-base (capping layers / selected sub grade) shall be compacted to not less than 98% and 95% of the maximum dry density respectively of the material as determined by BS 1377, test 13 (Modified Proctor). Where the sub-base is built up of more than one layer the layers to follow shall be placed only after the degree of compaction of the previous layer has been tested and found satisfactory. This process shall be preceded up to the bottom level of aggregate base course that shows in the construction drawings. The field density tests shall be carried out in every layer.

#### 5.6. Supervision.

Position	Responsibilities.
Site Engineer	Perform the edge treatment and/or widening on the basis of method statement, specification & construction drawings
Technical Officer	All setting out works in accordance with Method statement and drawings.
Foreman	Assist to Site Engineer/Technical officer.
Laboratory Technician	Carrying out relevant field tests.

#### 5.7. Inspection.

According to the attached Inspection & Test Plan “H” point “W” point inspection and tests shall be notified to Site Engineer. Site Engineer shall inspect site works as scheduled and report the checklist to QAM/QAI.

The inspection and Test Plan for relevant working area shall be available on site for the Engineer to see. Upon completion of the Inspection and Test Plan, the ITP shall be maintained at the company project office and submit to the Engineer with the progress claim

### 5.8. Traffic Control.

One traffic warden shall be assigned at unloading point to guide the dump truck when turning, reversing and unloading. Two flagmen shall be assigned on either side of the working area if the available space is narrow for traffic.

### 5.9. Safety Provision.

Warning signs shall be displayed in advance as well as in working area. Excavated area shall be barricaded with barricading tapes or by placing traffic cones. Traffic warden jackets are to be provided to all flagmen. Safety briefing for drivers on defensive driving will be given

### 5.10. Attached Forms.

5.10.1. Check List

5.10.2. Inspection and Test Plan.

## 6. ABC WORKS

### 6.1. General

This work shall consist of supplying, laying and compacting approved Aggregate Base Course (ABC) on prepared sub base or on an existing pavement in accordance with lines and levels.

### 6.2. Reference

- Particular Specification Section 6.2
- Standard Specifications for Construction and maintenance of road and bridges, 2<sup>nd</sup> Edition June 2009, published by the ICTAD (SCA/5)
- Contract Drawings
- Construction Drawings

### 6.3. Resources

#### 6.3.1. Material

No.	Material	Specification
1	Aggregate Base Course	Sub Section 405 Particular Specifications.

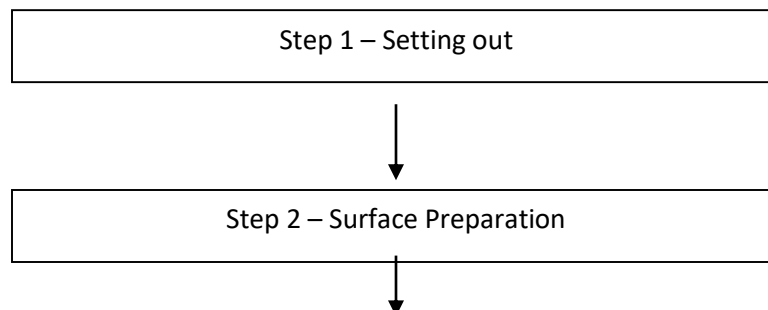
#### 6.3.2. Equipment/ Machinery (One unit)

No	Equipment/ Machinery	Qty
1	Backhoe Loader/Skid Loader	1
2	Dump Trucks / Tippers	As req.
3	10- ton Roller	1
4	Motor Grader	1
5	Water Bowser fitted with sprinkler bar	1
6	ABC Testing Laboratory Equipment	One Set
7	Straight Edges	1
8	Camber Boards	1

#### 6.3.3. Manpower (One unit)

No	Job Title	Qty
1	Site Engineer/TO	1
2	Supervisor	1
3	Laboratory Technician	1
4	Operator	3
5	Flagman	2
7	Labourer	8
8	Lab Helpers	02

#### 6.4. Flow Chart



Step 3 – Placing and compaction of ABC
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#### 6.5. Sequence of ABC Laying

**Step 1** Setting out the limits of ABC Overlay

The limits of ABC Overlay shall be set out with the lines grades and levels shown in the construction drawings. Level pegs shall be fixed as required at 10m interval to show the finished level of ABC.

**Step 2** **Preparation**

All loose material shall be removed from existing road surface or on the compacted sub base surface before laying ABC. The prepared sub base surface shall be watered where required before laying the Base Course. Where the Base Course is laid over an existing bituminous pavement, the preparation of the existing surface shall be carried out by cutting grooves with the roller tines / motor grader at one meter intervals to scarify the surface before laying the Base Course. During this operation, the under lying pavement layer shall not be damaged.

**Step 3** **Spreading and rolling of ABC.**

The transported ABC shall be dumped to the existing road or to the sub base surface at widening sections about 100m lengths.

Aggregate Base Course shall be spread uniformly over the prepared surface & leveled by motor grader to the lines, grades and levels marked on pegs allowing the layer thickness for the compaction of ABC. Water shall be added to ABC before spreading to avoid segregation. Additional water shall be sprayed using water bowsers on laid ABC before compaction. Base course shall be spread such that the thickness of each layer after compaction shall not be less than 75mm and shall not be greater than 200mm. All areas of segregated course and fine material shall be corrected by re-mixing or removing and replacing with well graded material. Compaction shall be done with 10 -ton vibratory roller to achieve the degree of compaction 98% of the Maximum Dry Density of the material as determined by BS 1377, test 13 (Heavy) or AASHTO T-180 (Modified). Rolling shall be commenced at the edge and proceed towards the center except the super elevation sections. The completed section shall be checked to the lines and levels shown in the construction drawings with the help of Straight Edge and Camber Board. The field density tests shall be carried out for every 500m<sup>2</sup> sections subject to a minimum of two tests for each section.

## 6.6. Supervision

Position	responsibilities
Site Engineer	Perform the ABC overlay and work on the basis of method statement & specification.
Technical Officer	All setting out works in accordance with Method Statement
Foreman	Assist to Site Engineer/ Technical Officer
Laboratory Technician	Carrying out relevant field tests.

## 6.7. Inspection

According to the attached Inspection and Test Plan “H point, “W” point inspection and tested shall be notified to Site Engineer. Site Engineer shall inspect site works as schedule and report the Check List to QAM/QAI.

The Inspection and Test plan for relevant working area shall be available on site for the Engineer to see. Upon completion of the inspection and Test Plan, the ITP shall be maintained at the Company Project Office and submit to the Engineer with the progress claim.

## 6.8. Traffic Control

Two flagmen shall be assigned on either side of the working area to facilitate the traffic in one way.

## 6.9. Safety Provision

Warning signs shall be displayed in advance as well as in working area. Working area shall be barricaded with barricading tape with painted barrels or by placing traffic cones. Traffic warden jackets are to be provided to all flagmen.

## 6.10. Attached Forms

6.10.1. Check List.

6.10.2. Inspection and Test Plan

# 7. PRIME COAT

## 7.1. General

This work shall consist of priming with MC 30 on Aggregate Base Coarse compacted surface.

## Reference

- Particular Specification Section 6.2
- Standard Specifications for Construction and maintenance of road and bridges, 2<sup>nd</sup> Edition June 2009, published by the ICTAD (SCA/5)
- Contract Drawings
- Construction Drawings

## 7.2. Resources

### 7.2.1. Material

No.	Material	Specification
1	MC 30	Sub Section 501 particular Specification
2	Sand or Quarry dust	Sub section 501 particular Specification

### 7.2.2. Equipment/ Machinery

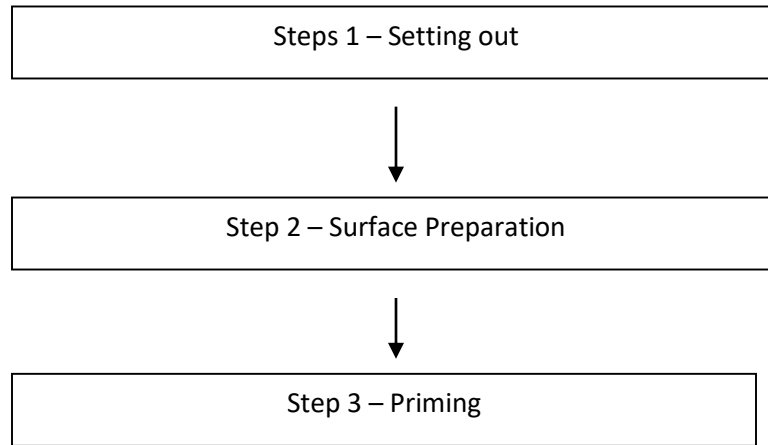
No	Equipment/ Machinery	Qty
1	Bitumen Sprayer / Hand Sprayer	1
2	Brooms/ Brushes	As required
3	Water Bowser	1

### 7.2.3. Manpower

No	Job Title	Qty
1	Supervisor	1
2	Laboratory Technician	1
3	Operator	2
4	Flagman	2
5	Labourer	6
6	Lab Helpers	02



### 7.3. Flow Chart



### 7.4. Sequence of Priming with MC 30

#### Step 1 **Setting out the limits of priming**

The limits of priming shall be set out with the lines grades and levels shown in the construction drawings.

#### Step 2 **Preparation**

Prior to application of prime coat, the base would be brushed to remove all dust, loose particles and other extraneous material and the surface would be moistened with water just before priming.

Where local irregularities in the existing surface are found, the surface would be brought to uniform contour by patching with fine particles of aggregate base course or an asphalt mixture to be approved by the Engineer.

#### Step 3 **Priming.**

The Compacted, firm and stable ABC surface shall be well brushed to remove excess fines, loose aggregate and other objectionable material with brooms and brushes. The brushed surface shall be dry or sufficiently low in moisture prior to the application of prime coat. The prime coat (MC 30) shall be applied by means of a Bitumen distributor, keeping the temperature within the limit of 40 – 60 °C. The prime coat shall be applied at a rate between 0.6 to 1.3 ltr /m<sup>2</sup>. The rate of priming shall be checked by tray test for every application.

Traffic shall not be permitted on the primed surface until the binder has sufficiently penetrated. Prime coat shall be checked visually weather it is

completely penetrated in to the ABC. If it is penetrated well, the road shall be opened to the traffic. Otherwise, spread a sufficient quantity of blotting material in order to prevent the prime coat from being picked up, prior to the allowing traffic to pass.

#### 7.5. Supervision

Position	responsibilities
Site Engineer	Perform the priming work on the basis of method statement & specification.
Technical Officer	All setting out works in accordance with Method Statement
Foreman	Assist to Site Engineer/ Technical Officer
Laboratory Technician	Carrying out relevant field tests.

#### 7.6. Inspection

According to the attached Inspection and Test Plan “H point, “W” point inspection and tested shall be notified to Site Engineer. Site Engineer shall inspect site works as schedule and report the Check List to QAM/QAI.

The Inspection and Test plan for relevant working area shall be available on site for the Engineer to see. Upon completion of the inspection and Test Plan, the ITP shall be maintained at the *Company Project Office* and submit to the Engineer with the progress claim.

#### 7.7. Traffic Control

Two flagmen shall be assigned on either side of the working area to facilitate the traffic in one way.

#### 7.8. Safety Provision

Warning signs shall be displayed in advance as well as in working area. Working area shall be barricaded with barricading tape with painted barrels or by placing traffic cones. Traffic warden jackets are to be provided to all flagmen.

#### 7.9. Attached Forms

7.9.1. Check List.

7.9.2. Inspection and Test Plan

## 8. SOFT SHOULDER

### 8.1. General

This work shall consist of,

- 8.1.1. Supplying; laying and compacting approved shoulder material on prepared surface or on constructed embankment on either side of the pavement.
- 8.1.2. Scarifying, trimming, Shaping and compacting the existing shoulder where specified in the construction drawings or as instructed by the engineer.

Shoulders shall be to the depths and widths as specified and as shown on the drawings.

### 8.2. Reference

- Particular Specification Section 6.2
- Standard Specifications for Construction and maintenance of road and bridges, 2<sup>nd</sup> Edition June 2009, published by the ICTAD (SCA/5)
- Contract Drawings
- Construction Drawings

### 8.3. Resources

#### 8.3.1. Material

No.	Material	Specification
1	Shoulder material	Sub section- 409 of Standard Specifications

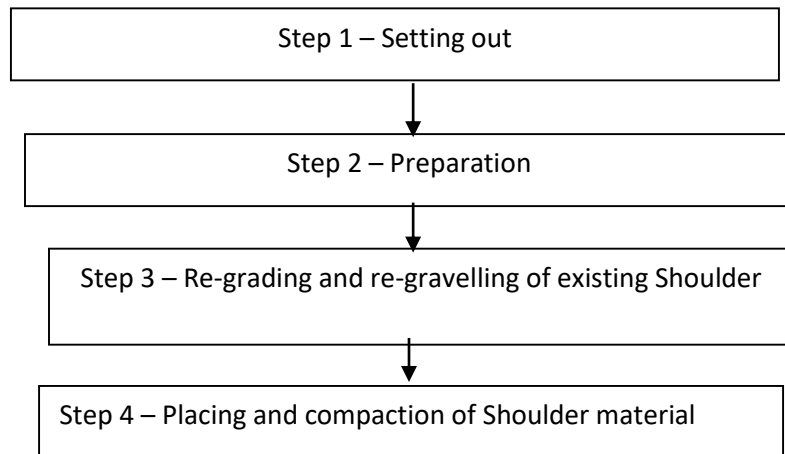
#### 8.3.2. Equipment/ Machinery (One unit)

No	Equipment/ Machinery	Qty
1	Backhoe Loader/Bob Cat	1
2	1 Ton Roller/4 -Ton Roller	1
3	Rammers	2
4	Dump Trucks / Tippers	4
5	Water Browsers	1
6	Soil Testing Equipment	One set

#### 8.3.3. Man power (One unit)

No	Job Title	Qty
1	Supervisor	1
2	Operator	3
3	Heavy Vehicle Driver	As req.
4	Labourers	8
5	Laboratory Technician	1
6	Laboratory Helpers	2

#### 8.4. Flow Chart



#### 8.5. Sequence of shoulder construction.

##### Step1 Setting out

The limits and levels of outer edge of the designed soft shoulder at every 20m interval (lesser interval at the curves) shown in the construction drawings shall be marked by fixing timber pegs. The height to be filled shall be demarcated by stretching a sting line between pegs.

## Step 2 Ground preparation

The areas of road widening by excavation or embankment construction, ground preparation for shoulder construction is not required. The existing shoulder shall be trimmed, leveled and shaped and compact to level shown in the cross sections. The trimming leveling and shaping shall be carried out manually in small section and by motor grader in large sections. Excavated soil shall be removed from the site to disposal yards using backhoe loader and dump trucks or farm tractors. The leveled surface or existing shoulder shall be compacted using rammers or 01 - ton/ 04- ton rollers to suit the site requirements. The outer edge of the carriageway shall be trimmed vertically depends on the width of the road. The trimmed material shall be collected and loaded manually and removed using tractors.

## Step 3 Re grading and re gravelling of existing Shoulder

In areas designated by the Engineer for re grading and re gravelling, the existing shoulder shall be scarified, trimmed and shaped with motor grader or manually, if required additional shoulder material shall be added to get required level and top surface shall be compacted with 8-ton roller.

## Step 4 Placing and Compaction of shoulder material

The shoulder material from approved borrow pits shall be excavated and stock piled before transport to site. Material shall be transported from stock pile to site using dump trucks. Material shall be spread by manually. In layers not exceeding 225mm. Where the shoulder is built up of more than one layer, the layer to follow shall be placed only after the degree of compaction of the previous layer has been tested and found satisfactory. If required, material shall be sufficiently wetted or dry up and compacted at or near the Optimum Moisture Content (OMC). The material shall be compacted by using a vibrating smooth wheeled 04- ton roller / 01- ton roller or rammer. The shoulder material shall be compacted to a density not less than 95% of the maximum dry density of the material as determined by the modified compaction test (BS 1377 test 13 or AASHTO T-180). The field density test shall be carried out of frequency of one test per every 200m<sup>2</sup>

### 8.6. Supervision

Position	Responsibilities
Site Engineer	Perform the shoulder construction on the basis of method statement, specification and drawings.

Technical Officer	All setting out works in accordance with Method Statement and drawings.
Foreman	Assist to Site Engineer/ Technical Officer

#### 8.7. Inspection

According to the attached Inspection and Test Plan “H point, “W” point inspection and tested shall be notified to Site Engineer. Site Engineer shall inspect the site works as scheduled and report the Check List to QAM/QAI.

The Inspection and Test plan for relevant working area shall be available on site for the Engineer to see. Upon completion of the inspection and Test Plan, the ITP shall be maintained at the Company Project Office and submit to the Engineer with the progress claim.

#### 8.8. Traffic Control

Two flagmen shall be assigned on either side of the working area, not to disturb the traffic flow specially after commencing the shoulder construction on either side of the road.

#### 8.9. Safety Provision

Warning signs shall be displayed in advance as well as in working area. Traffic cones shall be placed along the working area. Safety briefing for drivers on defensive driving will be given.

#### 8.10. Attached Forms

7.1.1 Check List.

7.1.2 Inspection and Test Plan

### 9. ASPHALT PAVING

#### 9.1. General

The asphalt pavement is the layer of asphaltic concrete constructed on the top of the sealed surface of Dense Grade Aggregate Base Course, which is composed of a combination of aggregates such as crushed stone and crushed dust theoretically graded to progressively fill the voids and mixed with bitumen to obtain the desired properties. Surfacing shall consist of wearing course only.

This work shall be carried out in accordance with specifications with lines, levels, grades, dimensions and cross sections as shown on the drawings

#### 9.2. Reference

- Particular Specification Section 6.2
- Standard Specifications for Construction and maintenance of road and bridges, 2<sup>nd</sup> Edition June 2009, published by the ICTAD (SCA/5)
- Construction Drawings
- Method of Asphalt Concrete Surfacing – Asphalt manual

### 9.3. Resources

#### 9.3.1. Material

No	Material	Specification
01.	Aggregate (Fine and Coarse)	Clause 1701 of – Standard Specifications.
02.	Penetration Bitumen (60 – 70)	Clause 1702 Standard Specifications.
03.	CRS I	Clause 1702.3 Standard Specifications.

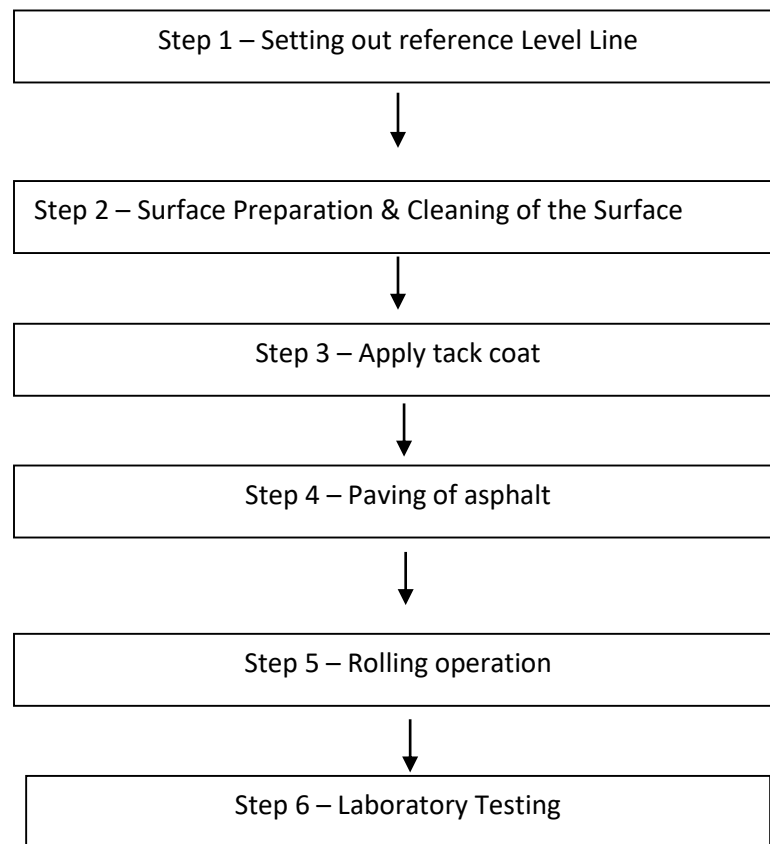
#### 9.3.2. Equipment/ Machinery (One unit).

No	Equipment/ Machinery	Qty
1	Asphalt Paver	1
2	Tack Coat Sprayer	1
3	10- ton Pneumatic roller (Steel drum)	1
4	Water Bowser	1
5	Pneumatic Tired Roller (PTR)	2
6	Testing Equipment	1
7	Dump Truck	As required
8	Air Compressor	1

#### 9.3.3. Manpower (One unit).

No	Job Title	Qty
1	Site Engineer/ Technical Officer	1
2	Supervisor	1
3	Operator	6
4	Skilled Labour	4
5	Labour	10
6	Flagmen	2
7	Laboratory Technician	1
9	Laboratory Helpers	2

#### 9.4. Flow Chart





## 9.5. Sequence of Asphalt Construction

### Step 1 Preparation of existing Surface

Prior to spreading of the asphalt concrete surfacing, the newly constructed surface shall be cleaned of extraneous matter and dust as per paragraph 1 of sub section 501.3 (b), and shall be free of moisture and shall not be opened for traffic.

The bituminous mix shall not be laid during rainy weather or when the surface on which it is laid is damp or wet.

### Step 2 Mixing plant and the preparation of Mix

After approval of the established mix design, we would start the mixing of the Asphalt concrete with the asphalt batch mixing plant installed at ....., owned by .....Company.

Prior to the commencement of mixing, the aggregate and binder proportioning scales would be calibrated so as to produce a satisfactory mixture with all particle coated with bitumen.

The combination of aggregates would be of the type and size specified, and the gradation, when screened and graded in the percentage proposed, which shall be within the limits of the grading specified for the mixture.

The aggregates would be dried and mixed; the binder would then be added in a spread pipe over the full length of the mixer. The mixing would be continued for a minimum of 30 seconds, but under no circumstance shall the total mixing time be more than 60 seconds. Specification and asphalt manual should be the guide documents to follow.

#### Care should be taken on,

- Temperature is to be checked (shall be between 145°C to 170°C)
- uncoated aggregate is to be examined for
- excess bitumen is to be examined for
- materials are to be weighed

### Step 3 Setting out the limits of Surface Dressings

The limits of Surface dressing shall be set out as shown with the lines in the construction drawings or as directed by the Engineer. Lines of center and the edge shall be marked with paints.

#### **Step 4 Tack Coat**

Tack coat will be applied at an application rate of 0.25 to 0.5 l/m<sup>2</sup> by means of Distributor or hand sprayer. To check the application rate two tray tests will be conducted daily. Tack coat is allowed at least 20 min. for drying and laying shall be completed before 6 hours of the application of tack coat.

#### **Step 5 Transport of mix**

The mix shall be transported from the mixing plant to the point of use to the site. The trucks shall be in good mechanical condition at all times. Each loaded shall be covered with a properly fastened canvas or other suitable material of such size as to protect the mix from weather or dust.

Loading and transporting shall be coordinated such that spreading, compacting and finishing shall be completed during daylight hours. Otherwise, adequate illumination will be provided as approved by the Engineer.

#### **Step 6 Paving**

The asphalt concrete would be paved by paver. The mixture would be spread and finished in lane widths applicable to the specified typical section and thickness shown the construction drawings. In irregular areas, the mixture may be spread and finished by hand. The paving depth is automatically controlled by correcting the deviation from the mechanical guide sensor detected with the controllers in the longitudinal and transverse directions of the road.

To begin paving operation with the paver, the screed would be heated minimum 20 minutes to get the proper temperature and grade controls set to construct the transverse joint. The transverse joint would be made into inclined and trimmed to a near vertical face, and coated with a thin layer of tack coat prior to the placing of fresh material adjacent to the joint.

#### **Step 7 Compaction procedure**

Immediately after the mix has been spread and struck off, the surface shall be checked and any irregularities adjusted. Rolling shall commence as soon as the material will support the roller without undue displacement or cracking. After spreading, the mixture would be thoroughly and uniformly compacted by tandem static steel rollers in conjunction with pneumatic type roller as sequence of initial rolling, secondary rolling and finishing rolling. At all times, the motion of the roller would be slow and uniform to avoid displacement of the mixture.

The initial rolling would be undertaken by steel roller of capacity not less than 8MT as high temperature as practicable not less than 135 °C without causing undue displacement of the asphalt. The rolling would commence as close behind

the paver as practicable from the lowest side towards the center in a longitudinal direction with the powered driven rolls nearest the paver except for crossing rolling at transverse joint.

The secondary rolling by pneumatic tired roller of capacity not less than 15 tons, Would be started at least 4 to 6 passes immediately as above described after the 2 Passes of the breakdown rolling, until the desired compaction density is reached, and no roller marker are visible.

Finishing rolling by smooth wheel static roller would be carried out at a temperature not less than 90 °C, and would be continued until all roller marks are eliminated and no further compaction is possible.

#### **Step 8 Laboratory Testing**

- Rate of application of tack coat shall be tested using tray test.
- Temperature of each and every truck load of asphalt to be tested before unloading to the paver and make sure it to be maintained above 135°C.
- Samples to be collected for conducting of lab tests (Marshal, Bitumen Extraction)
- Obtain core samples before opening to traffic.
- All relevant test will be carried out at .....’s Laboratory

#### **Step 9 Aftercare**

Section of the newly finished work shall be protected from traffic of any kind until the mix has sufficiently hardened. Also, traffic shall normally, not be permitted over newly laid surface at least for twelve hours after laying or the temperature of the newly laid surfacing has achieved the ambient temperature.

#### **9.6. Supervision**

Position	Responsibilities
Site Engineer	Perform the asphalt construction work on the basis of method statement & specification.
Technical Officer	All setting out works in accordance with Method Statement.
Forman	Assist to Site Engineer
Lab Technician	For laboratory testing

### 9.7. Inspection

According to the attached Inspection and Test Plan “H point, “W” point inspection and tests shall be notified to Site Engineer. Site Engineer shall inspect site works as schedule and report the Check List to QAM/QAI.

The Inspection and Test plan for relevant working area shall be available on site for the Engineer to see. Upon completion of the inspection and Test Plan, the ITP shall be maintained at the Company Project Office and submit to the Engineer with the progress claim.

### 9.8. Traffic Control

Two flagmen shall be assigned on either side of the working area to facilitate the traffic in one way.

### 9.9. Safety Provision

Warning signs shall be displayed in advance as well as in working area. Working area shall be barricaded with barricading tapes with painted barrels or by placing traffic cones. Traffic warden jackets are to be provided to all flagmen.

### 9.10. Attached Forms

9.10.1. Check List.

9.10.2. Inspection and Test Plan

## 10. SLOPE PROTECTION

### 10.1. General

This work shall consist of

10.1.1. Supplying; and spreading approved top soil on prepared surface of embankment slopes on either side of the road.

10.1.2. Placing compacting with hand rammers and fixing in place with pegs to avoid sliding down when watering is done.

Turf shall be to the widths as specified and as shown on the drawings.

### 10.2. Reference

- Particular Specification - Section 6.2

- Standard Specifications for Construction and maintenance of road and bridges, 2<sup>nd</sup> Edition June 2009, published by the ICTAD (SCA/5)
- Contract Drawings
- Construction Drawings

### 10.3. Resources

#### 10.3.1. Material

No.	Material	Specification
1	Top soil	Sub section- 409 of Standard Specifications [SCA/5]
2	Turf in sod form as approved by the Engineer	Sub section- 409 of Standard Specifications [SCA/5]

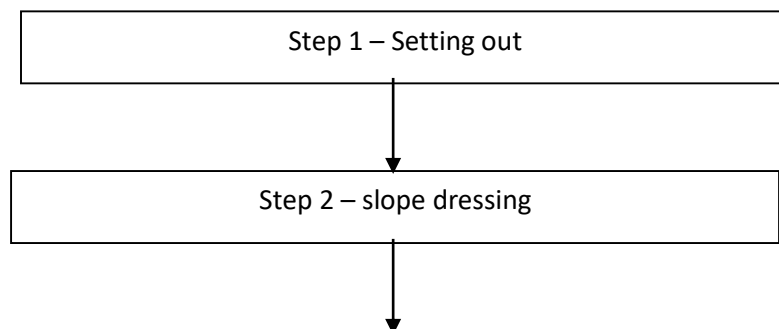
#### 10.3.2. Equipment/ Machinery (One unit)

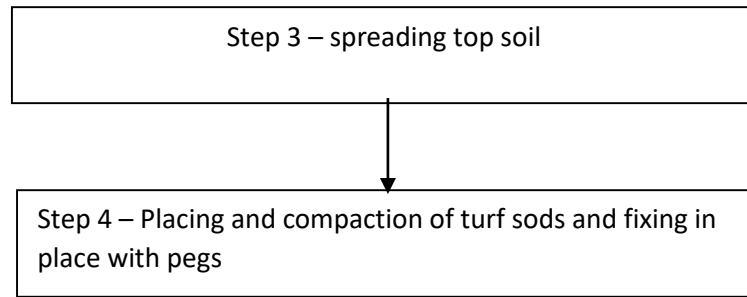
No	Equipment/ Machinery	Qty
1	Backhoe Loader/Bob Cat	1
2	Tractor trailer / Tippers	2
3	Water Browsers	1

#### 10.3.3. Man power (One unit)

No	Job Title	Qty
1	Supervisor	1
2	Labourers	10

### 10.4. Flow Chart





#### 10.5. **Sequence of shoulder construction.**

##### Step1 Setting out

The limits and levels of toe edge of the designed soft shoulder at every 10m interval (lesser interval at the curves) shown in the construction drawings shall be marked by fixing timber pegs. The correct slope shall be marked by scraping down the loose material in shoulder and embankment fill at 10 m intervals manually using a template or by giving levels with leveling instrument.

##### Step 2 Slope dressing

These corrected slope points will be connected by the backhoe loader or the skid loader. The earth material will be collected and taken for reuse or to the spoil yard depending on the contamination level of the fill material. Then the slope will be compacted with hand tampers

##### Step 3 Placing top soil

The top soil will be unloaded in small heaps at suitable intervals in required quantities and will be placed on the slope manually by shovel and mammoth. Then the slope will be compacted with hand tampers

##### Step 4 Fixing turf sods in place

Turf sods will be cut from designated place and brought to site by tractor trailer or tipper and unloaded manually at site in suitable intervals so that with the single handling, the sods are placed on the slope and rammed with wooden tamper manually for proper positioning of sods. Sod is fixed in place by jungle timber pegs driven in the sod to the slope surface. Regular watering is done until the turf takes roots and appears lush green

#### 10.6. **Supervision**

Position	Responsibilities
Technical Officer/survey assistant	All setting out works in accordance with Method Statement and drawings.
supervisor	Assist marking correct slope and ensure the work is done as per method statement

#### 10.7. **Inspection**

According to the attached Inspection and Test Plan “H point, “W” point inspection and tested shall be notified to Site Engineer. Site Engineer shall inspect the site works as scheduled and report the Check List to QAM/QAI.

The Inspection and Test plan for relevant working area shall be available on site for the Engineer to see. Upon completion of the inspection and Test Plan, the ITP shall be maintained at the Company Project Office and submit to the Engineer with the progress claim.

#### 10.8. **Traffic Control**

Traffic cones shall be placed on the shoulder edge at suitable intervals in the work area with men at work boards on either end

#### 10.9. **Safety Provision**

Safety jackets will be worn by the supervisor and the workers. Drivers of transport vehicles and operators will be briefed of safety in operation where road traffic is allowed freely.

#### 10.10. **Attached Forms**

- 10.10.1. Check List
- 10.10.2. Inspection and Test Plan

### **11. ROAD FURNITURE AND ROAD MARKING**

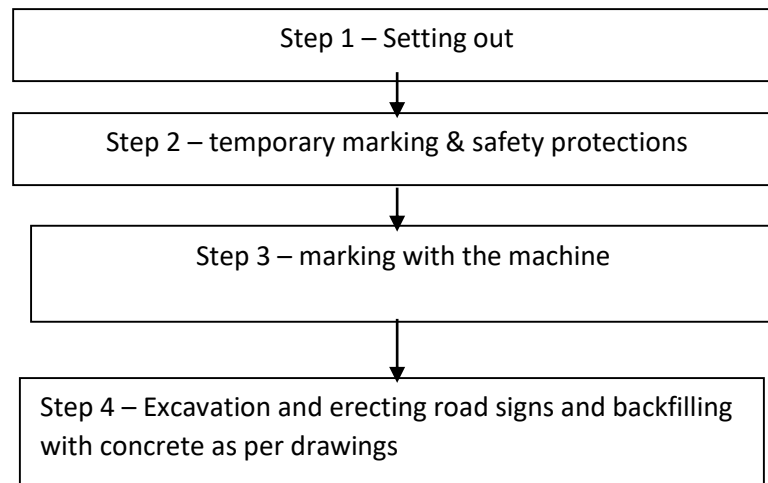
#### 11.1. **General**

This work shall consist of

- a) Marking road centerline, edge lines [if directed], pedestrian crossings, bus bays, etc.
- b) Fixing sign boards, safety barriers, etc.

Work shall be to the requirements as specified and as shown on the drawings.

11.2. **Flow Chart**



11.3. **Sequence of road marking and sign board fixing.**

Step1 Setting out

The centerline is marked at 10 m intervals and the off set for the edge line are marked. On the same movement the pedestrian crossing points and sign board points are also located on the shoulder by pickets.

Step 2 – Temporary marking and safety protections

Temporary markings are done using paint dots using straight edge for straight sections and using the rope for curve sections.

Step 3 – Marking with the machine

Machine is filled with the mastic and at the correct temperature while moving on the polythene the flow is allowed and the forward movement is done at right speed which is done by an experienced skilled person. The speed is such that no gaps or air bubbles are seen on the mastic fallen on the ground. Always the helpers are available with the protection materials so that no mastic is fallen on outside the required places.

Step 4 - Fixing road furniture



Road furniture will be fixed as per drawing at the right place to be at the right height as per drawing. Pits will be excavated and the pipe will be placed in position properly plumb using stakes 3 or 4 and the base will be filled with concrete.

**11.4. Supervision**

Position	Responsibilities
Technical Officer/survey assistant	All setting out works in accordance with Method Statement and drawings.
supervisor	Assist marking correct; fixing the furniture as per drawing; and curing the concrete base for 01 week

**11.5. Inspection**

According to the attached Inspection and Test Plan “H point, “W” point inspection and tested shall be notified to Site Engineer. Site Engineer shall inspect the site works as scheduled and report the Check List to QAM/QAI.

**11.6. Traffic Control**

Traffic cones will be placed on the road edge at suitable intervals in the work area with men at work boards on either end

**11.7. Safety Provision**

Safety jackets will be worn by the supervisor and the workers. Transport vehicle drivers and operators will be briefed of safety in operation where road traffic will be allowed in one lane.

**11.8. Attached Forms**

11.8.1. Check List.

11.8.2. Inspection and Test Plan

### **Annexure – 3 - Supervision manual - A sample**

## Supervision manual – A sample

### Description of Approach, Methodology and Work Plan for Performing the Assignment

In order to comply with the project requirements and carry out the required services fully, in an efficient way, proper work methodology has to be developed. The following sub-sections briefly describe our proposed approach and methodology for the execution of the services required. The proposed methodology has been developed based on the consultant's understanding of the Request for Proposal and Terms of Reference requirements, and defined scope of services.

#### 1. Consultant Approach and Proposed Work Plan

Successful delivery of a project is based upon developing a close working relationship with the Client (*name of the organization.....*). The consultant will keep all communications related to the project through a single point of contact, the Team Leader/Resident Engineer who will manage the working team during construction supervision and defect liability period stages. He will keep close contact and coordination with the Project Director from *name of the organization .....* as well as the Contractor for the construction of [*name of project.....*] Road'.

The actual implementation of the project starts upon holding a commencement [kick off] meeting with the officials to introduce the Engineer's representatives and contractor's staff and the Employer's representatives to be frequently engaged in the project. Project Work plan and milestones, quality standards, specific regulations, communication channels, staff recruiting and mechanisms of approval, data requirements and sources, support needs and any other required particular needs will be discussed here.

Another meeting is attended by consultant's representatives Team Leader, Important Personnel for Design Review Group, Resident Engineer and the key staff of the construction supervision team. The needed review process of the design documents such as pavement designs, geometry and structures etc. are discussed to check for more attempts needed to optimize the design for employer's requirements and practical limitations at site.

The consultant will mobilize the team in stages to undertake the diversified tasks for all initial design review, construction supervision and defect liability evaluation as well as the relevant management activities. The Team leader supported by the specialists will initiate the design review. The supervision team shall initiate monitoring and supervising of the day-to-day contractors' activities on permanent basis from start of field work and throughout the construction period.

Both design review group and supervision team activities shall be logistically and technically supported as may be necessarily by backup staff from the consultant's home offices in [...Colombo]

Records of test results, meetings minutes, work done, and project documentation shall be maintained to evidently prove execution of works in accordance with the contract requirements. Problems, solutions, and consequent delay (if any) shall be addressed in the monthly and periodic reports, focusing on describing the problem, initiating overcoming measures, and reach status to rectify the work and resolve the problems for successful implementation of the Project.

Upon substantial completion, the consultant shall prepare the Project Completion Report, which shall summarize all important elements and experiences of the project. The report shall be available shortly after provisional acceptance of the works. Evaluation and estimations for any defects during defect liability period shall be reported at the end of the defect liability period after working for such inspections on regular basis as planned and given in the work plan.

## **2. Scope of Work**

The scope of work as defined in the Terms of Reference (TOR) generally comprises Design Review, Construction Supervision and defect analysis during defect liability period for the road sections [*give name(s).....*]

Such scope of work could be distributed along three stages and split into the following subtasks:

### **Stage 1) Pre-construction Stage:**

In this project pre-construction stage is already passed

- Design review of road works and structures, and recommendations will be informed to the employer as and when required;

### **Stage 2) Construction Stage:**

- Mobilization;
- Site administration;
- Quality control, including survey check, inspection and non-conformity management, testing,
  - a) Evaluation of day-to-day contractor's work activities, and results documentation;
  - b) Assist employer in time and progress control; Procurement Control
  - c) Approval of contractor's Quality Assurance plan and method statements,
  - d) Early warnings to employer not to exceed the allocated budget;

- e) Contract management including variations orders and claims management;
- f) Review contractor's submittals for approval process;
- g) Review, check and certification of Payment applications;
- h) Project documentation and reporting.

### **Stage 3) Completion Stage and Defects Liability Period:**

- Checking of works done and preparation of the snag lists
- Recommendation of remedial measures and monitoring
- Issuing of the substantial completion certificates;
- Participate in handing over activities; and
- Review and approve the as-built drawings and final payment certificate.

## **3. Proposed Methodology**

The following sections briefly describe our proposed methodology to perform each of the above tasks:

### **3.1. Pre-construction Stage**

After contract comes into force, the consultant shall mobilize the design review group, the team leader and the contract management specialist to initiate undertaking the tasks of design review and amend and make improvements if any. The team leader will distribute the received design documents to the engineers of relevant disciplines for review (Roads, Pavement, Structural, Hydrology, etc.), while the contract management specialist and supporting staff will undertake the evaluation process of the contract documents for conformity with the said construction supervision works.

The following sections highlight the main issues that shall be tackled during the performance of these tasks.

#### **3.1.1. Design Review**

The designs review process shall be undertaken during the initial stage (first months) after the commencement. The objective of the design review is to identify any technical issues that may represent potential problems during the construction stage, and generally to emphasis on the following issues:

- Conformity to design and safety codes and local regulations.
- Compatibility of the design documents with each other, and no discrepancies.
- Adequacy of presented information, to avoid inaccuracies/ misinterpretations during construction.
- Forecasting of financial overrunning if any

The detailed review for different design disciplines shall be undertaken as follows:

#### **3.1.1.1. Roads Design Review**

- Check & confirm geometric design (typical cross sections, alignment and profile details) based on approved criteria and be within right of way [ROW];
- Check & confirm the adequacy of the pavement structure for the different road elements (main road, service road, ramps, loops...etc.)
- Check & confirm if the conditions have been significantly differed from that of estimated conditions. based on forecast traffic loads and sub grade conditions;
- Check & confirm the typical details, roads furniture details, and traffic safety features; and
- Make sure that road drawings are well coordinated with the structural and drainage drawings.

#### **3.1.1.2. Drainage Works Design Review**

- A) Check the route of the flood water based on topographical maps, and physically at site
- B) Check the sufficiency the newly proposed drainage structures (bridge, culverts, pipes, channels, etc.) including scouring and sizing;
- C) Check flood protection measures (side slope protection, ditches, dykes, chutes, etc.);
- D) Check the performance and size of the existing storm water drainage structures.

#### **3.1.1.3. Structural Design Review**

- Check the general arrangement;
- Check concrete dimensions of bridges and other structures elements;
- Check reinforcement;
- Check type of foundations based on the site condition or approved geotechnical references or investigations report;
- Check the sufficiency of the types and capacity and efficiency of bearings, and expansion joints if applicable.

The consultant shall identify the potential areas where possible improvements could be introduced to enhance the design efficiency and its compatibility with the local construction industry, and those might affect the timely completion of construction by the contractor, including constructability recommendations.

Design review will be done in stages in parallel with initial stages of construction where setting out and material source approvals are in progress and outcomes of the review and recommendations, highlighting the issues that require correction or clarification will be informed to the employer by the Project Manager.

Any change of design resulting from this review will be instructed to the contractor ONLY with the consent of the Employer

### 3.2. Construction Stage

#### 3.2.1. Mobilization of the Supervision Staff

After awarding of the civil work contract and mobilization of the contractor, the consultant mobilized the construction supervision team from...../... 2019. As shown in the subsequently attached team organization chart, the supervision team shall be with the Resident Engineer. The Resident Engineer will report to the Team leader. Relevant officers are made responsible for the daily supervision activities in road sections, as per the contractor's daily program. The consultant has submitted to the Employer a list of the proposed team members with their qualifications and credentials for approval prior to assigning in the project.

Engineer's facilities that shall be provided by the [*contractor or the consultancy company*] (site offices and means of transportation) are to be secured simultaneously with team mobilization to avoid hindering of work.

Following the mobilization, the Project Manager /Team Leader, Resident Engineer, and key staff have undertaken a field reconnaissance of the project road. The purpose of this initial field mission is to obtain general familiarity with the project areas, current condition, terrain, drainage, traffic and site working conditions.

The team leader and his staff will initiate their site duties by undertaking the following tasks:

- A) Make sure that all design drawings including amendments (if any) are finally approved/consented by employer and submitted complete to the contractor;
- B) Make sure that the contractor is well mobilized in terms of manpower, plants, site offices, laboratory yard space(s) and equipment;
- C) Fix the communication channels with employer, the contractor and stakeholders through the employer);
- D) Review and check project quantities (BOQs) to ensure their compatibility with the allocated budget and scope of work given/needed;
- E) Review and evaluate the contractor's work plan, time schedule including procurement plans and priorities;
  - Check the adequacy of the contractor's resources, equipment including plants, technical office and staff, and labor force;
  - Prepare a schedule for regular progress review meetings with employer [including representatives of stake holder as relevant] and the contractor and arrange for other meetings when required;
- A) Fix the procedures for checking process and approvals; and

- B) Review the quality and safety plans of the contractor and fix the QA/QC and safety polices that shall be followed during implementation.

### **3.2.2. Site Administration**

The consultant will check the contractor's temporary facilities already mobilized to ensure its suitability, organization, quality and adequacy. High attention will be given to construction plants, temporary structures, and storage and casting yards, all to be well set-up, rationally interconnected and sufficient to fulfill their intended functions.

The consultant will request the contractor during mobilization period and before final moving-in to submit a layout plan for all temporary facilities required for approval. The consultant will check the proposed facilities for sufficiency, adaptability, and non-interference to the last extent possible with the permanent works. [Unless beyond the contract conditions]

The consultant will request the contractor to submit for approval all necessary documents concerning the field-testing laboratory installation and equipment including a plan for purchase, delivery and installation within the stipulated time in the contract.

### **3.2.3. Quality control**

At the commencement of the project, the contractor is liable to submit his proposed quality plan for consultant's checking and approval. The consultant shall review the Quality Plan to ensure addressing the following requirements:

- Description of QC system;
- Identification of work procedures;
- Identifying relevant codes and standards;
- Organizational set up with defined roles and responsibilities;
- Inspections and test plan and procedures;
- Process of material procurement, delivery and approval,
- Managing of deviations and non-conformities;
- Tests results Records and documentations; and
- Preventive and corrective actions for non-conformities.

All materials to be used shall be presented to the consultant for inspection, testing and acceptance before incorporation into the Work. Based on the approved Quality Plan procedures and requirements, the consultant will monitor the quality of the daily construction activities and used materials including earth works, asphalt, concrete works, electrical and other incidental works.

Due consideration shall be given to safety measures particularly for traffic detour works to secure safety of the road users, particularly during night-time.

The consultant's site supervision team will be responsible for ensuring that all materials, inspection and testing are performed in accordance with the requirements of the contract,



specifications, construction procedures, applicable codes, and approved drawings. They will be also responsible for developing and maintaining the documentation system that controls the quality standards and ensuring that the adequate records are maintained for controlling results and monitoring conformance with specified requirements.

For each completed work, the contractor shall be required to submit a check request in the form of RFI to the Resident Engineer to check and approve before proceeding to the next work step. The check request shall state the date, type, limits and location of the work or the element ready for checking. The Resident Engineer in turn will distribute the request for the involved staff member of his team to conduct the necessary check and the specified laboratory or site tests in accordance with approved QC plan.

Following points in the process of constructions will be considered hold points for engineers' compulsory inspection but this list will not disqualify the engineers request and wish to carry out further inspections as and when deemed necessary.

1. Setting out and level accuracy check - for accuracy and soil condition to necessary depth
2. Screed and Base Concrete-Depth and soil condition check
3. Form work- For dimensional accuracy
4. Reinforcement- for conformity with designs
5. Before covering any work – for acceptance of workmanship & taking necessary measurements

## **1. Earth Works**

### **➤ Excavation**

1. Excavation will be checked in accordance with the design levels. The excavated material will be used for fill if it complies with the project specifications for embankment sub-grade and sub- base materials;
2. Selection of the suitable equipment for excavation depending on the soil type and the depth of excavation;
3. Checking of the dimensions, levels of excavation using accurate and calibrated surveying instruments;
4. Checking of side slopes using the calibrated surveying instruments; and
5. Disposition and disposal of the surplus excavated material as stipulated in the contract

### **➤ Earth Fill for embankment, sub grade, Sub base**

- Selection of the borrow pits to collect the fill materials;
- Proper clearing and grubbing;
- Testing and classification (grading, fine material content, Proctor tests, and CBR... etc.);
- Selection of the suitable equipment for transportation, spreading, and compaction;
- Fill shall be carried out on layers where the thickness shall be determined according to the type of fill material and/or as specified;
- Checking of the dimension and levels of each layer using accurate and calibrated surveying instruments;
- Checking of levels and slopes using the calibrated surveying instruments;

- Measuring the field density of the compacted fill material by using approved method, and calculate the degree of compaction to the frequency stipulated in the contract and/or QA Plan approved;
- Checking the final level of sub-grade layer and sub base layer, as the case may be.

## **2. Base Course Layers**

- Selection of the crushed aggregate for base course;
- Testing of crushed aggregate to determine the properties and its suitability for use as base course as stipulated in the contract
- Review and witness the design mix and compaction trials;
- Selection of the suitable equipment for transportation, spreading, and compaction of the crushed aggregate base course;
- Checking of the levels and the thickness of base layer to be at least 15 cm or in accordance with compaction trial test results;
- Measuring the field density of the compacted base layer by using approved method and calculate the degree of compaction.

## **3. Asphalt Works**

- Testing of bitumen materials; and testing of different ingredient of asphalt works including coarse and fine aggregates and filler (grading, Los Angeles test, absorption, .etc.) as elaborated in the contract and other industry accepted documents like MS2 of the asphalt institute
- Review and witness the mix design for different asphalt layers using Marshal or Super Pave mix design methodology;
- Calibration of the asphalt mixing plant;
- Inspection of equipment used for transportation, spreading, and compaction of asphalt works;
- Testing of the asphalt layer by Marshal test and density test;
- Checking of compaction, thickness of asphalt, and levels;
- Testing of road surface as stipulated in the contract for International roughness index parameters
- Inspection of the road marks

## **4. Structural Works**

The structural works such as bridges, retaining walls and culverts shall be executed in accordance with the approved drawings and construction method statement, to the dimensions and the levels required using the suitable equipment and approved materials.

The Structural Engineer will follow the procedures for checking the construction methods using a check list for each activity and according to the quality control plan including structural excavation, shoring, form works, reinforcement, concreting, curing and finishing.

➤ **Structural Excavation**

- Structural Excavation shall be executed according to design levels taking into consideration the possibility of re-use of excavated material as in fill if it complies with the project specifications;
- Selection of suitable equipment for excavation depending on soil type and depth of excavation;
- Checking of the dimension and levels of excavation using calibrated surveying instruments;
- Checking of slopes using the calibrated surveying instruments; and
- Disposition and disposal of surplus excavated material.

➤ **Cast-in-Place Concrete**

- Selection and testing of materials for concrete (cement, aggregates, water, and admixture for concrete), reinforcement, water stops, joint sealer, joint filler... etc.);
- Design of concrete mixes, and trial mixes;
- Storing concrete materials;
- Cutting, bending, and fixing of reinforcement;
- Construction joint and movement joint;
- Erection and removal of formwork; and
- Testing of fresh and hardened concrete (slump, strength...etc.);

➤ **Post Concreting Work**

- Record Shutter stripping times and check for compliance with the specification;
- Record the curing method, date, and time of commencement of curing;
- Inspection of concrete surface after stripping the forms and prior to any remedial work, to identify defects or deviations;
- Caulked up tie holes as soon as practical after form removal; and
- Repair the minor surface defects such as ridges, surface honeycombing, voids and cracks, in accordance with the applicable specifications.

➤ **Formwork**

- Checking of formwork design calculations;
- Inspection of forms, form coating, slip form machines;
- Tolerances, (dimension, lines, elevations and positions of the joints); and
- Lining material (if any).

➤ **Reinforcement**

- Testing of samples of reinforcing steel, or check of the manufacturer's testing certificates;
- Inspection of reinforcing steel bars lists and bar bending schedules and drawings;
- Inspection of bar supports for coated reinforcement; and

- Inspection of mechanical connections.
- **Accessories**
  - Approval of the supplier and materials including bearing, water stop, and expansion joints...etc.
  - Inspection of the accessories or certified manufacturers test report for each element;
  - Ensure that number, types, capacity and sizes of bearing to be as specified or as shown on the approved drawings;
  - Check type, dimensions, level and location; and
  - Inspection of storing Conditions.

All works, inspection and tests will be undertaken in compliance with the quality requirements of the contract as well as the approved quality plan and test procedures. Where nonconformities are found or identified, they will be addressed on the check request and notified to the contractor for rectification and recheck as explained in the 3.2.4 above. The laboratory test results shall be evaluated and documented, while the final result shall be conveyed to the contractor, as well as the quantity surveyor for considering the relevant approved quantities in the payment certificate.

During the manufacturing and construction, the contractor shall be entitled to allow and facilitate the consultant to inspect and test the materials being prepared or manufactured in workshops or factories out of the working site as relevant. The contractor shall be entitled to obtain permission for the consultant representative to carry out such inspection in those workshops or out places. Such inspection or testing shall not release the contractor from any obligation under the Contract.

#### **3.2.4. Process of material procurement, delivery and approval**

Materials procurement source approval process will be implemented as shown in the flow chart annexed.

##### **3.2.4.1. Flow chart for materials approval**

Please see page Flow chart for materials approval in the appendix 1

#### **3.2.5. Handling Non-Conforming work and Products**

The consultant shall be authorized to reject / hold any of non-conforming works or materials that were out of the specifications/requirements. The consultant shall inform the contractor on such cases with a non-conformity report in the earliest time possible, so that the contractor can propose necessary corrective and preventative action with the approval of the Engineer and implement necessarily rectification without affecting the progress of the works.

The Nonconformity report will be raised either by the Contractor's Quality Assurance Manager or by the Engineer. Handling process of both these NCR is described in the flow charts annexed.

Please see appendix 2

#### **3.2.6. Correspondence Flow Chart**

Please see page in the appendix 4

#### **3.2.7. Flow chat for routine communication [Daily Program/RFI/RFT/Approvals]**

Please see page in the appendix 5

#### **3.2.8. Flow chart for drawing approval**

Please see page in the appendix 6

#### **3.2.9. Flow chart for Interim Payment Certificates**

QAM will do a quality audit every 3 months [or as agreed] to evaluate and carry out statistical analysis for test results in order to determine the degree of control of the contractor and to determine the causes for the variation in the test results.

Errors and deficiencies identified by the quality control staff shall be addressed by "Corrective Action Request (CAR)" forms and statements obtained from the responsible supervisor with regard to the cause of the condition, the action taken to correct the condition, and the action taken to prevent a recurrence of the condition.

The Resident Engineer and QAM will follow the procedures for checking the approved construction method designed for the project. The site monitoring and tests witnessing shall mainly be conducted for the following activities:

#### **3.2.10. Contractors method statements**

Prior to the start of any site activity, the consultant will ask the contractor to submit a clearly formulated and well-documented method statement, meeting the work program, for the consultant's approval. Such method statement is to include:

- Method of construction;
- Manpower resources and equipment to be used;
- Safety precautions and traffic management if necessary

- Duration.

Submission of such method statements should be made early enough to allow review and approval by the consultant before the start of physical construction activities, included in the QA plan. For complex activities, Separate method statements in detail will be insisted for the contractor to submit and checked and approved by the Engineer

### **3.2.11. Time Schedule and Progress Control**

#### **3.2.11.1. Work Plan and Time Schedule**

The contractor's work plan with time schedule (Construction Program) covering all project activities will be checked and approved including method statement, financial progress 'S' Curve and resource schedules. The critical activities will be identified and monitored carefully

The time schedule should address the milestones and Employer's priorities set forth in the project tender.

The progress monitoring will be based on these approved submissions

A careful attention will be made to ensure that:

- Compliance of the work program with contract requirements, milestones
- Sequence of equipment mobilization, providing temporary facilities, materials procurement, and delivery of shop drawings, review, approvals and inputs of the sub-contractors are well correlated;
- Compliance of the contractor's procurement plan with the project milestones and time schedule, particularly considering lead time;
- Any potential problem areas and obstacles that may affect the works and progress, and appropriate actions will be identified.

#### **3.2.11.2. Progress Control**

The contractor will be requested to submit his monthly/weekly /daily programs [as agreed] and targets for resource and financial achievements based on the main program and schedules mentioned in 3.2.10.1 above

The monthly achievements will be discussed and agreed with the contractor and will be reported in monthly progress reports

Progress review meetings will be arranged at, weekly /bi- weekly /monthly intervals [as agreed]. The meetings shall be attended by the representatives of contractor, consultant and Employer to discuss the overall progress situation, identify causes of delay and how they should be overcome.

A site visit to the works shall be undertaken by the members of the meeting to discuss any pending issues on the spot.

#### **3.2.11.3. Contract Management**

The consultant, in its capacity as the “Engineer” assume an independent managerial role, whereby the resident engineer assisted by the contract management specialist will administer the contracts of the entire project fairly and justly between Employer and the contractors, to ensure that their rights are safeguarded in accordance with the terms of the contract. The consultant will cover the aspects associated with the administration of the construction contract that mainly include:

- Review the compilation of contract documents;
- Administer the contracts firmly and fairly;
- Ensure all contract requirements are fulfilled;
- Review of the cost to maintain project budget;
- Review and certify contractor’s payment certificates;
- Management of claims, negotiate and resolve in strict accordance with the contract conditions;
- Initiating and processing variation orders for employer’s approval;
- Facilitate resolving matters and disputes amicably, and contractually if needed;
- Review project contractual and financial matters; and
- Perform and report the closing of the project.

#### **3.2.12. Review of Contractor’s submittals**

After the traffic control plan quality control plan, time schedule, and Hygiene, Safety Environmental plans are approved, and prior to start in any site activities, the contractor shall be requested to submit the following for the consultant’s review and approval:

- Detailed shop drawings of required construction element;
- Detailed construction method statement including safety precautions as necessary;
- Data sheets, technical specifications of any material to be supplied to the site;
- Tests results certificates issued from the manufacture for any imported materials;
- Qualification of any potential suppliers, providers and/or subcontractors;
- Operations and maintenance manuals;

Submission should be made early enough to allow review and approval by the consultant before the occurrence of the planned early start of the respective program activities.

### **3.2.13. Health, Safety and Environment (HSE) Management**

The contractor shall prepare and submit HSE plan for consultant review and approval following the guidelines given in special specifications. The main objective of such HSE plan is to provide information so that supervisors and workers can identify potential hazards and establish precautionary measures so that injuries, damages incidents and environmental negative impacts are avoided. Strict adherence shall be maintained to the approved safety plan.

The consultant shall ensure that plan is addressing the following requirements:

- Contractors' code of ethics and HSE policy;
- Organizational set up with defined roles and responsibilities;
- HSE orientation and training;
- HSE communication system;
- HSE training competence and awareness;
- Hazard identification and risk analysis;
- Incident reporting;
- Corrective and preventive measures on incident;
- Medical facilities plan;
- HSE Inspections and records;
- Nonconformity complaints and improvements;
- Safe working practices;
- Contractor's camp facilities and welfare facilities;
- Controlling all site related risks;
- Procedures for permits to work on all activities;
- Transport and traffic safety management;
- HSE aspects on storage facilities;
- Emergency response plans; and
- Personal qualifications audits and training.

The Health, Safety and Environmental (HSE) plan shall be reviewed, amended and updated as may be needed.

### **3.2.14. Traffic Management**

The contractor is required to provide traffic Management plan as stipulated in the contract. The Plan shall be acceptable to all the relevant authorities and the Police. The contractor shall provide evidence to the effect that the plan has been met with above conditions before the commencement of any construction activities on site.



## **4. Reporting**

The objective of reporting is to provide employer with detailed status of the project along its different implementation stages. In addition to the reports that shall be submitted by the contractor, the consultant shall prepare and submit to employer the following series of reports:

### **4.1. Inception Report**

In order to keep Employer acquainted with the activities being taken place during the early stage of construction, four weeks after commencement of construction works, the consultant will prepare and submit to P I U / P M U of Employer the Inception Report, explaining the findings and the preliminary arrangements took place at during this period of the project. The inception report will mainly include the following information:

- Project background
- Preliminary activities took place during this period;
- Status of equipment and work force moved to the site;
- consultant staff mobilized to the site;
- Site office arrangements for consultant and contractor;
- Site laboratory and equipment;
- Contractor's submittals so far Time Schedule, QC plan, HSE Plan, shop drawings, etc.);
- Status of the project time schedule;
- Relevant site photos; and
- Conclusion and recommendations.

### **4.2. Monthly Progress Reports**

During the construction period, the consultant, before the end of 15<sup>th</sup> workdays of every month, will submit to PIU/ PMU of Employer the monthly progress report that contains the project activities took place and progress achieved during the previous month. The monthly progress report shall be submitted in one copy or as mutually agreed between the parties in a format agreed. The monthly progress report will be mainly structured as follows:

- General Information: project summary description project data, Layout plan, and;
- Changes in status of equipment and work force moved to the site;
- Changes in consultant staff mobilized to the site;
- Brief description of the works completed; Summary of project status and current project activities;
- list of planned activities, bar charts, and planned vs. actual in quantities;
- % Programmed vs. % actual works for the month and cumulative to date in financial terms;
- The works to be performed during the coming month- most likely vs. as in accepted program;
- Materials approvals sought during the month

- Obstacles and actions taken;
- Obstructions and details of any delay in the works and the cause of delay, indicating whether the delay of any part will cause delay to the whole works;
- Time extension record (if any);
- Procurement and delivery of materials (planned versus actual);
- Issues and their status;
- Variation orders and claims (if any);
- Quality Control: will include brief review of contractors' compliance with the approved Project QA Plan, narrative statement cross-referenced with test results, and action taken toward poor results; status of NCR
- Approved subcontractors;
- Minutes of site meetings record;
- Conclusion and recommendations.

The monthly report shall be associated with the following appendices:

- Photos of different site activities;
- Summary of Laboratory and field tests done
- Tables and charts as required

#### **4.3. Project Completion Report**

As construction work approaches full completion, the contractor will apply to the Team Leader [or Resident Engineer] to issue Completion Certificate. The Team Leader [or Resident Engineer] in response to this application shall arrange for a joint inspection of the work as it stands. The snag lists for items that is outstanding, and defects have to be prepared separately by the Resident Engineer upon the inspection.

The completed list will be passed to the contractor by the Team Leader [or Resident Engineer] expressing his decision that whether the work done is sufficiently and satisfactorily completed and hence warrant preparation of the completion certificate, or further completion or remedial work is required. Such decision shall be notified in writing to the contractor.

The consultant will prepare and submit to Employer a Completion Report giving all information about the completion status, "as-built conditions" including, drawings, test reports and final cost analysis.

Once the work is satisfactorily completed as agreed with the contractor, the Engineer may issue the certificate of completion. The defect liability period will be commenced from the date of issue of completion certificate and the Engineer will continue to supervise defect liability period as given in the contract.

The report by the Engineer shall summarize all important elements and experience of the project and shall be available shortly after provisional acceptance of the works. It will cover, among others:

- Compilation and description of the different execution aspects of the project;

- Outstanding work and snag lists;
- Recommended remedial action;
- Compiling main data and features of the project;
- Concluding the effectiveness of project implementation;
- Recommendations for Handover and future maintenance measures;
- Cost compilation and financial analysis; and
- Contractor liabilities during maintenance period.

#### 4.4. Defect Liability Period

The post-construction activities and supervision of the defect's liability period includes supervision of project completion, of outstanding work items completion, and of the remedial action for defects.

Services under this task include the regular inspections on site and the supervision of remedial / residual works demobilization from site and reinstatement of areas temporarily occupied during the contract.

A critical technical inspection of all structures will assure that all defects will be detected. The contractor(s) will then be instructed to remedy them immediately. All remedial works shall be inspected and approved by the consultant.

**If the consultancy contract period is not extended for this work the employer will make suitable supervision arrangement and inform the Engineer before 2 weeks of his alternative arrangement and advise the transfer procedures of files, information and any other object that was available with the Engineer and deemed necessary for the continuation of supervision by the new entity.**

A sample list of duties is given below
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#### LIST of DUTIES

**Team Leader** [= Project Manager in this sample project]

1. Leading the team to meet the project requirements, balancing the mismatches in the TOR of consultancy agreement and the supervision needs of the construction contract, within limits in the best possible manner
2. All correspondence with the contractor and the employer
3. Coordinating and utilizing services of visiting staff, i.e. QA manager, Highway Design Engineer & Contract specialist
4. Approval of construction program, method statements and QA manual

5. Preparation of measurement / payment application formats to be agreed with the contractor
6. Preparation of formats for reports, routine records,
7. Approval of method of construction on special works and in emergency situations
8. Analysis of contractor's claims and send for perusal by contract specialist
9. Decide on required structure modifications to be presented to the employer's acceptance
10. Initiating Taking over process

## **Construction supervision team**

### **1. Resident Engineer (RE)**

- 1.1 Assisting PM/TL on all contract related matters
- 1.2 Act for PM/TL in his absence from site for a day or more
- 1.3 Approval of drawings submitted by the contractor
- 1.4 Coordinating with QS and recommending payment certificates for PM's certification
- 1.5 **Guide the Secretary cum Office manager in record keeping and retrieving** [*key action for being able to defend claims*]
- 1.6 **Take responsibility of all correspondence handled by the office**
- 1.7 Preparation of minutes of meetings until the secretary develops to take the responsibility
- 1.8 Preparation of monthly and quarterly reports with the guidance of TL
- 1.9 Check running chart and vehicle movement and certified records by SE & ME and hand over to secretary to be sent for payments to main office
- 1.10 **Check Office manager/secretary work is proper and registers are updated and letters are filed properly** [*key for being able to defend claims*]
- 1.11 Consult TL to stop work. No single- handed decision is authorized on this matter
- 1.12 Officially receiving Request for Inspection [RFI] through the secretary and distributing to SE/ME

### **2. Site Engineer (SE)**

- 2.1 Keeping record of request for inspection [RFI] from contractor through Secretary [who will physically receive the sheet; - depends as per accepted QA manual]
- 2.2 Ensure being available at required places by TO/ME/SSO/RE/ESO as the case needs
- 2.3 Obtain guidance from RE/TL to ensure no mistake is committed on supervision or approval matters from the PM[TL]'s staff
- 2.4 Assist PM/TL in computer checking of drawings if so required

- 2.5 Be in charge of the vehicle provided for the supervision team and ensure transport of the team 2 TO Surveyor and SE.
- 2.6 Ensure transport needs of ME and MT are met
- 2.7 Release the vehicle to SSO and ESO needs without affecting site work; inform RE/TL if not possible
- 2.8 Check running chart and vehicle movement and certify records and ensure Secretary cum office manager sends them properly and in time to main office in Colombo
- 2.9 Bring to the notice of PM/TL or RE any deviations in construction from drawings, or QA manual observed at site as soon as possible depending on the gravity of the problem immediately or within the day.
- 2.10 Consult PM/TL to stop work. No single- handed decision is authorized on this matter
- 2.11 Ensure the contractor's daily planned work is not hampered because of any reason by PM[TL] 's staff
- 2.12 Check Office manager/secretary work is proper and registers are updated and letters are filed until RE takes complete control over this work
- 2.13 Checking As- built drawings on completion

### **3. Materials Engineer (ME)**

- 3.1 Receiving and keeping record of request for testing [RFT] of materials [at the lab] or works [at site] from RE [who will physically receive the sheet, - depends as per accepted QA manual]
- 3.2 Ensure being available at required places by MT/SE as the case needs
- 3.3 Obtain guidance from QAM [PM/TL in his absence] to ensure no mistake is committed on witnessing or approval matters from the PM's staff
- 3.4 Be in charge of the vehicle [when provided] for the testing team and ensure transport of the others [SSO & ESO] in sharing without affecting he work
- 3.5 Check running chart and vehicle movement and certify records hand over to RE
- 3.6 Bring to the notice of PM/TL or RE any deviations in construction from drawings, QA manual observed at site as soon as possible depending on the gravity of the problem immediately or within the day.
- 3.7 Consult PM/TL to stop work. No single-handed decision is authorized on this matter
- 3.8 Take part in subsoil investigation where so decided by the project
- 3.9 Ensure the contractor's daily planned work is not hampered because of any reason by PM's staff

#### **4. Traffic and safety Engineer**

- 4.1 Monitor traffic and safety arrangements at site
- 4.2 Prepare weekly report on those matters and send to contractor under TL's signature
- 4.3 Follow up contractor's corrective action
- 4.4 Assist RE and SE in their duties
- 4.5 Assist in preparation of periodic reports by being the coordinator to complete different sections of the report prepared by sectional officers and hand over to RE to finalize the report by 20th of the following month

#### **5. Technical Officer**

- 5.1 Get directives from SE [in absence of him from RE]
- 5.2 Get guidance from RE/TL regarding specifications and QA manual and method statement
- 5.3 Read and understand specification requirement for each type of work well before the activity starts as per construction program
- 5.4 Supervise construction works to ensure use of approved material, correctness of levels and lines, achievement of proper finish, cleanliness of work, and work place
- 5.5 Check setting out of road or structure work with the help of the surveyor where such help is required
- 5.6 Witness and check field tests carried out by the contractor's staff in absence of ME or MT
- 5.7 Check work by inspection of the place to receive construction material, for cleanliness, dryness, or moistness required as per specifications, correctness as per drawings
- 5.8 Taking joint measurements of work that may be covered by the work to start next
- 5.9 Taking joint measurements on request by the contractor's staff as at agreed stages and manner [i. e. follow standard method of measurements] as in specifications and BOQ
- 5.10 Assist SE in record keeping of RFI and measurements
- 5.11 Assist QS in checking payment certificates where required, regarding the measurements jointly taken by the TO

#### **6. Materials Technician**

- 6.1 Get directives from ME [in absence of him from RE]
- 6.2 Get guidance from PM/TL regarding specifications and QA manual and method statement

- 6.3 Read and understand specification requirement for each type of work well before the activity starts as per construction program
- 6.4 Witness and check field tests carried out by the contractor's staff as per the request forms/daily program
- 6.5 Assist ME in record keeping of RFT and test report copies
- 6.6 Assist QS in checking payment certificates where required, in identifying relevant test references

## **7. Surveyor**

- 7.1 Get directives from SE [in absence of him from TL/RE]
- 7.2 Get guidance from TL/RE regarding specifications and QA manual and method statement
- 7.3 Liaise with contractor regarding establishment of survey control points
- 7.4 Supervise proper undisturbed maintenance of them by the contractor
- 7.5 Check all surveying and leveling works done by the contractor
- 7.6 Keep all needed records of survey work for accurate construction as well as for measurement/payment purposes
- 7.7 Suggest suitable changes to alignment within ROW available and levels to SE and TL to be decided for implementation after discussion with PM and the employer
- 7.8 Assist QS in checking payments where required, regarding surveying & leveling works
- 7.9 Assist the SE and TO in supervision works when not involved in surveying related works
- 7.10 Guide the Drafter on road work drawings and plotting and area /volume calculations
- 7.11 Assist SE/RE in checking as built drawings

## **Other staff**

### **1. Quantity Surveyor [QS]**

- 1.1 Receiving from Secretary cum Office manager and checking all payment applications submitted by the contractor
- 1.2 Keeping necessary records for checking payment applications
- 1.3 Preparation of variation orders under the guidance of PM/TL and submission for his checking and recommendation to be submitted to the employer
- 1.4 Preparation of required rate analyses
- 1.5 Preparation of half yearly revised BOQs with the guidance of PM
- 1.6 Assist RE and secretary to prepare monthly progress reports

- 1.7 Provide RE with information regarding financial progress for progress review meetings at site or ministry
- 1.8 Keep track of expiry dates of bonds and insurances
- 1.9 Keep a record of EOT approved and assist PM to inform to the contractor as well as those in the process
- 1.10 Keep a record of all payments made
- 1.11 Checking of final account

## **2. Drafter**

- 2.1 Prepare all drawings as directed by surveyor, SE, RE or PM
- 2.2 Check drawings plotting sent from the contractor under the guidance of relevant officers
- 2.3 Calculate quantities from road drawings
- 2.4 Keep records of own work under the guidance of SE and Surveyor

## **3. Secretary cum Office manager**

- 3.1 Assisting the Project manager in managing the office matters.
- 3.2 Typing of letters with correct letter reference numbers.
- 3.3 Keeping a record of incoming and outgoing letters in hard register.
- 3.4 Maintaining an excel register of all correspondence including e-mails faxes and letters exchanged in such a way needed letter can be sorted by date, reference number or first few words of the heading.
- 3.5 Making arrangements for the meetings held in this office.
- 3.6 Handling petty cash and dealing with reimbursement process.
- 3.7 Preparation and collection of duly filled time sheets and sending to main office with PM's signature.
- 3.8 Maintaining vehicle running chard records for the month obtaining regularly and properly from the officers in charge of vehicles.
- 3.9 Settlement of dues to the officers and keeping necessary records for payments agreed with the main office.
- 3.10 Liaise with the service providers and settle them as per the agreements made with main office for cleaning, electrical and plumbing services and computer hardware and software matters.
- 3.11 Assist RE for preparation of monthly invoice support documents.
- 3.12 Distributing minutes of meetings as directed by RE
- 3.13 Any other duties signed by PM will be added.



#### **4. Office helper**

- 4.1 open the office before others come and close after others have left
- 4.2 ensure the lights, computers and A/C are switched off and on as required
- 4.3 attend PM's bell calls
- 4.4 preparation of refreshment etc. for meetings
- 4.5 Assist secretary on filing letters in correct files in proper order
- 4.6 Any other duties signed by PM will be added.

#### **Visiting staff**

##### **1. Quality Assurance Manager (QAM)**

- 1.1 Co-ordinate with PM/TL [RE in PM/TL absence] at times of visits to site
- 1.2 Liaise with PM/TL and contractor's relevant staff on quality related matters
- 1.3 Approval of source materials of all types and mixes proposed by the contractor through RE
- 1.4 Approval of laboratory for PM's acceptance in writing
- 1.5 Checking calibrating certificates of necessary instruments at the right intervals of time
- 1.6 Assisting RE in checking QA manual and method statements
- 1.7 Guiding the ME and MT
- 1.8 Assist the team in evaluation of subsoil condition
- 1.9 Assist PM/TL in base strengthening decisions
- 1.10 Half yearly system audit to ensure QA proposal is effectively implemented in the project and making proposals to achieve aim of QA manual

##### **2. Highway Engineer**

- 2.1 Coordinate with PM and main office MHEC on times of visits to site
- 2.2 Liaise with RE and CR during site visits
- 2.3 Inspect and propose needed changes /report to PM and MHEC

##### **3. Contract Specialist**

- 3.1 Visit site on request. Visit site and study issues with PM/TL when dispute situation is declared by Contractor or employer
- 3.2 Coordinate with PM/TL and main office MHEC on times of visits to site, if situation in 3.1 has not arisen
- 3.3 Assist and guide PM/TL on request regarding EOT matters, Variations
- 3.4 Contractor's claim evaluation

#### **4. Social safeguard officer [SSO]**

- 4.1 Assist PM/TL on all matters related to social aspect of the project
- 4.2 Monitor social safeguard specification requirement being implemented at site.
- 4.3 Observe at site any deviations or omissions and report to PM /TL.
- 4.4 Prepare drafts or make comments on all correspondence received on social matters from any party and give to PM / TL.
- 4.5 Assist PM/TL in preparation of monthly progress report with regard to social aspects of the project following the requirements of appendix B of the contract document.
- 4.6 Be aware of the true situation regarding property condition and access survey carried out by the contractor before construction in selected work sections.
- 4.7 Initiate /coordinate/ participate grievance redress committee [already formed by PIU] matters representing the consultants.
- 4.8 Coordinate the HIV/AIDs program with the contractor on request by the PIU, as and when needed

#### **5. Environmental safe guard officer [ESO]**

- 5.1 Assist PM/TL on all matters related to environmental aspect of the project.
- 5.2 Monitor environmental safeguard specification requirement being implemented at site.
- 5.3 Observe at site any deviations or omissions and report to PM /TL
- 5.4 Prepare drafts or make comments on all correspondence received on matters from any party and give to PM / TL.
- 5.5 Assist PM/TL in preparation of monthly progress report with regard to environmental aspects of the project following the requirements of appendix B of the contract document.
- 5.6 Be aware of the true situation regarding property condition and access survey carried out by the contractor before construction in selected work sections.
- 5.7 Initiate /coordinate/ participate grievance redress committee [already formed by PIU] matters representing the consultants.

### **Appendices**

#### **Appendix 1: Flow chart for materials approval**

#### **Appendix 2:**

- a. **Flow chart for NCR & QOR (Engineer Generated**

**b. Flow chart for NCR & QOR (Contractor Generated)**

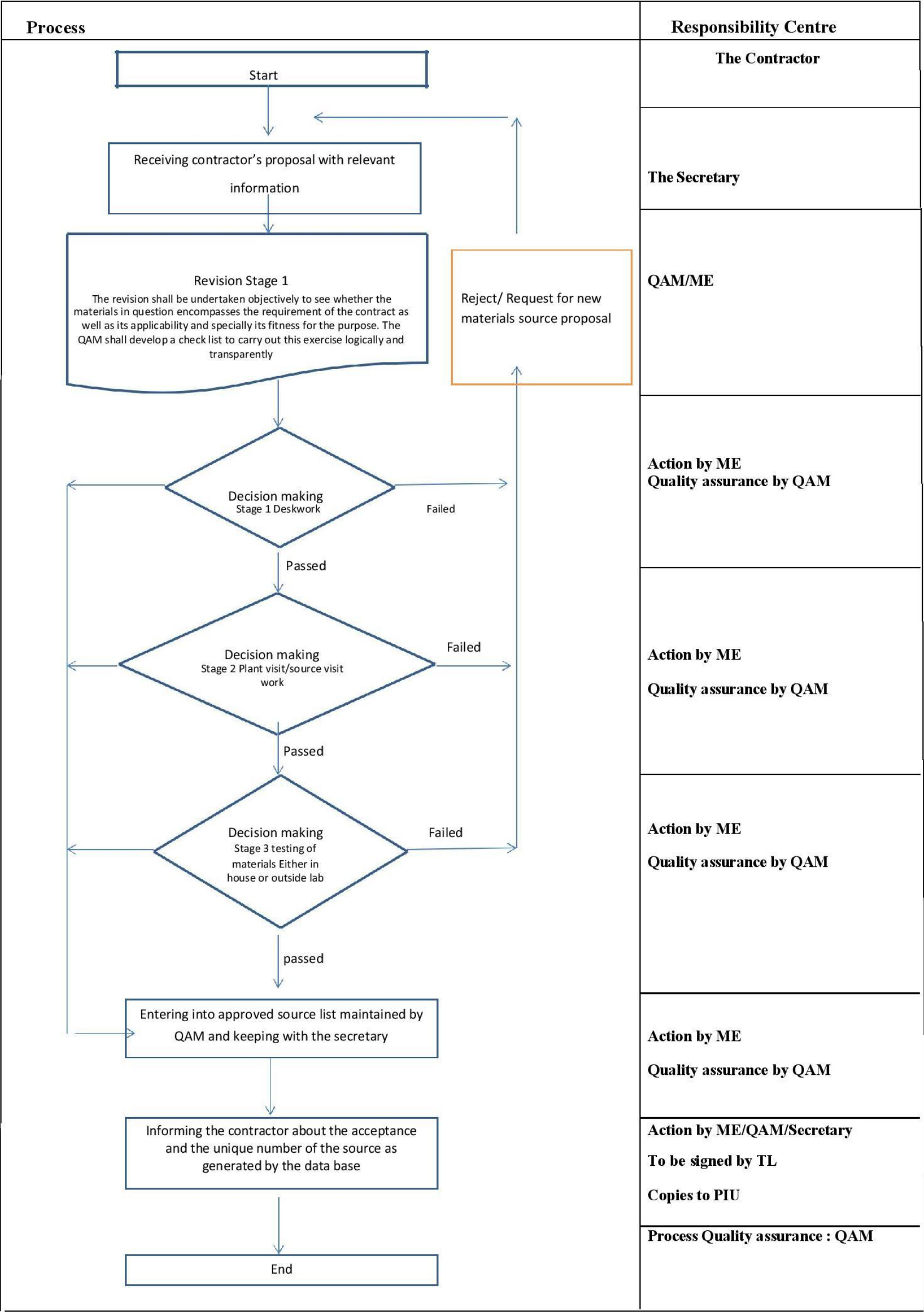
**Appendix 3: Correspondence Flow Chart**

**Appendix 4: Flow chat for routine communication** [Daily Program/RFI [Inspection} /RFT  
[Testing] /Approvals

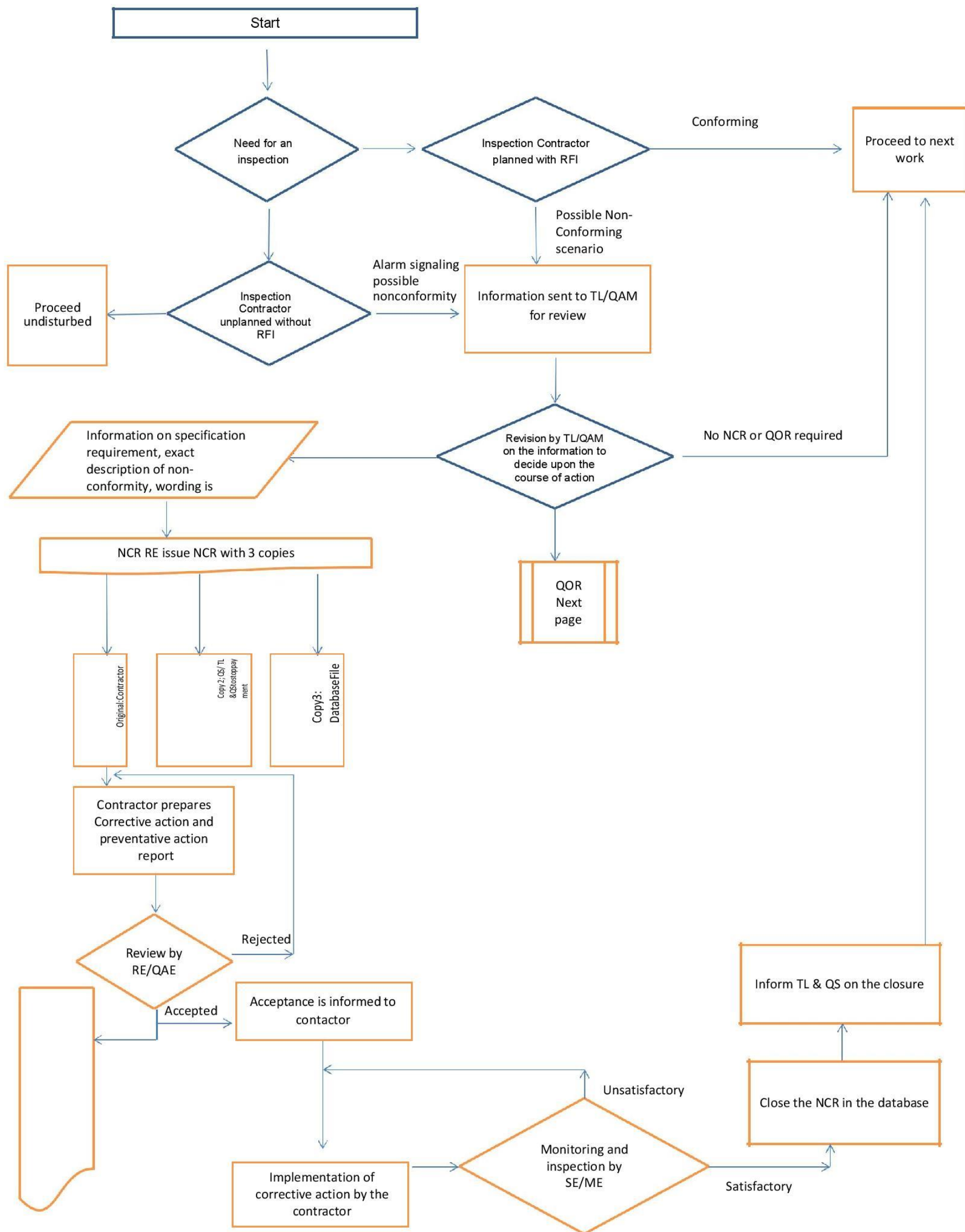
**Appendix 5: Flow chart for drawing approval**

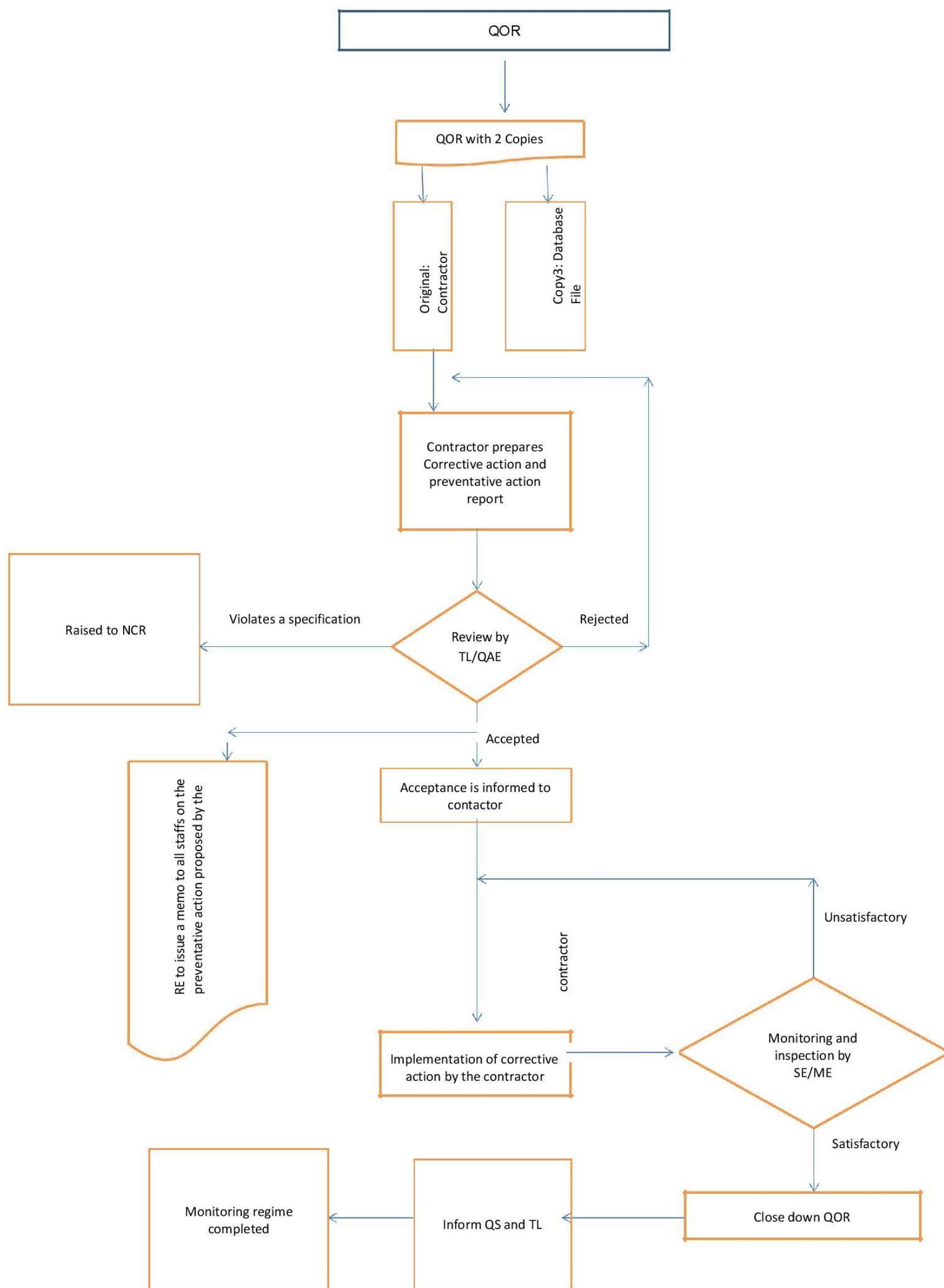
**Appendix 6: Flow chart for receiving IPA and issuing IPC**

Appendix 1: Flow chart for materials approval

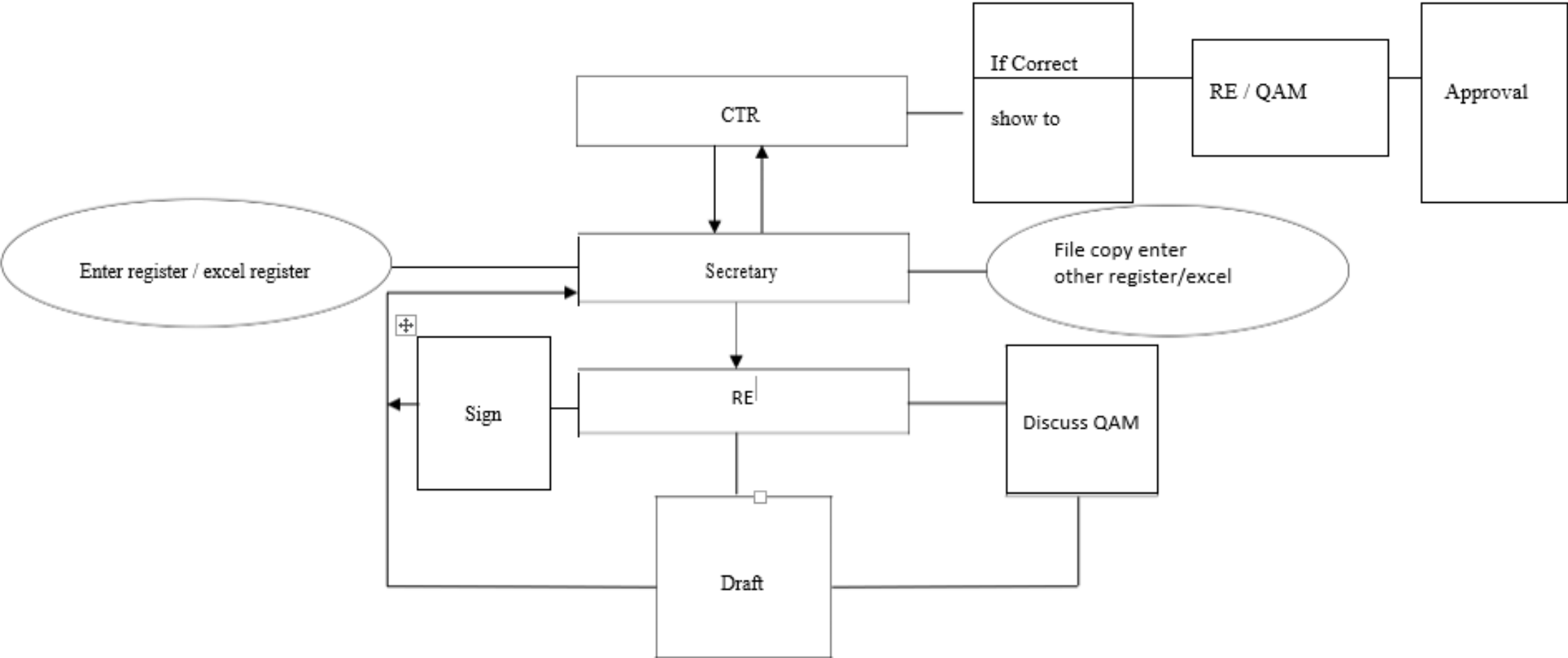


**Appendix 2: Flow chart for NCR & QOR (Engineer Generated)**

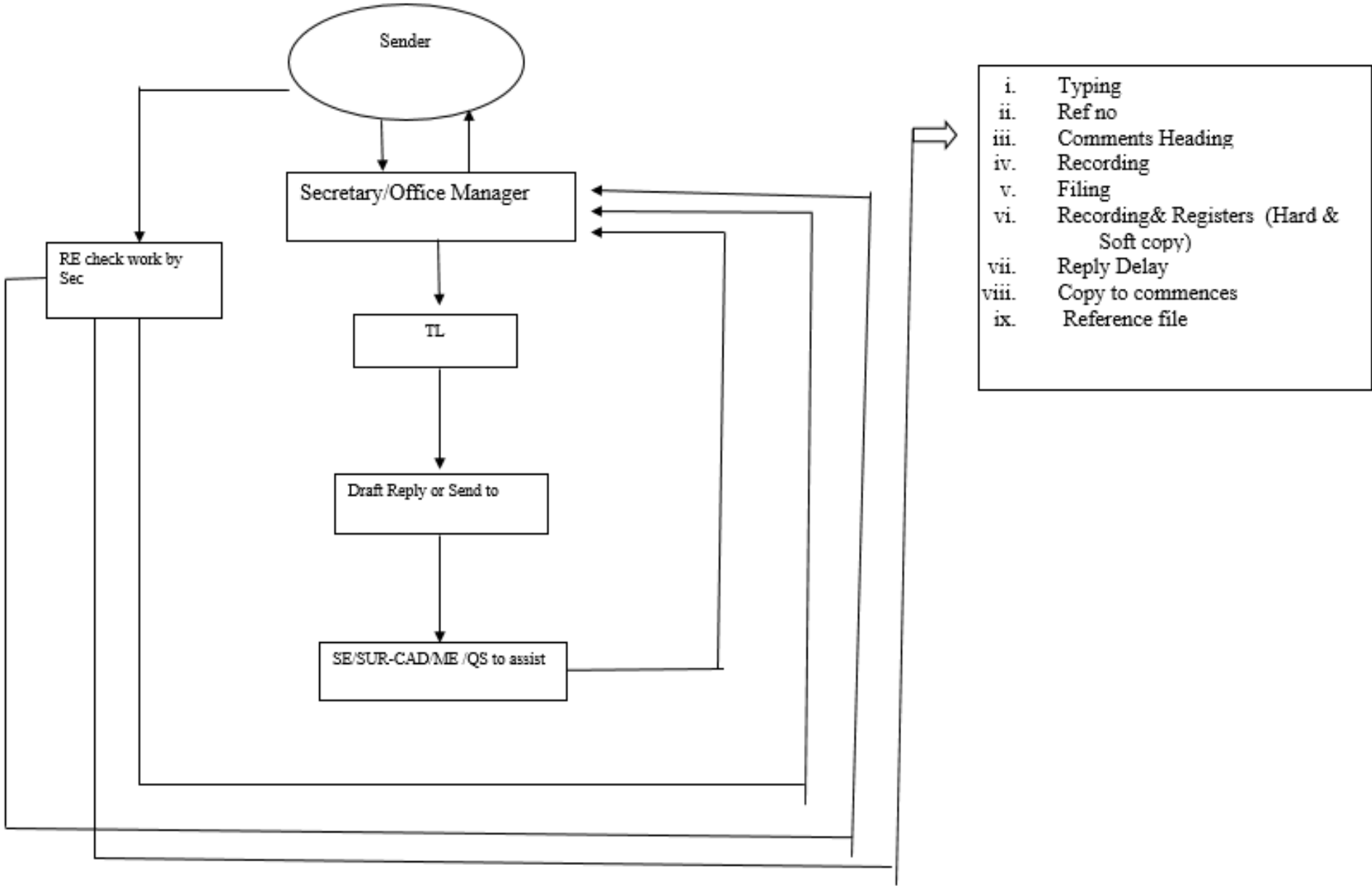




Appendix 3: Flow chart for NCR & QOR (Contractor Generated)

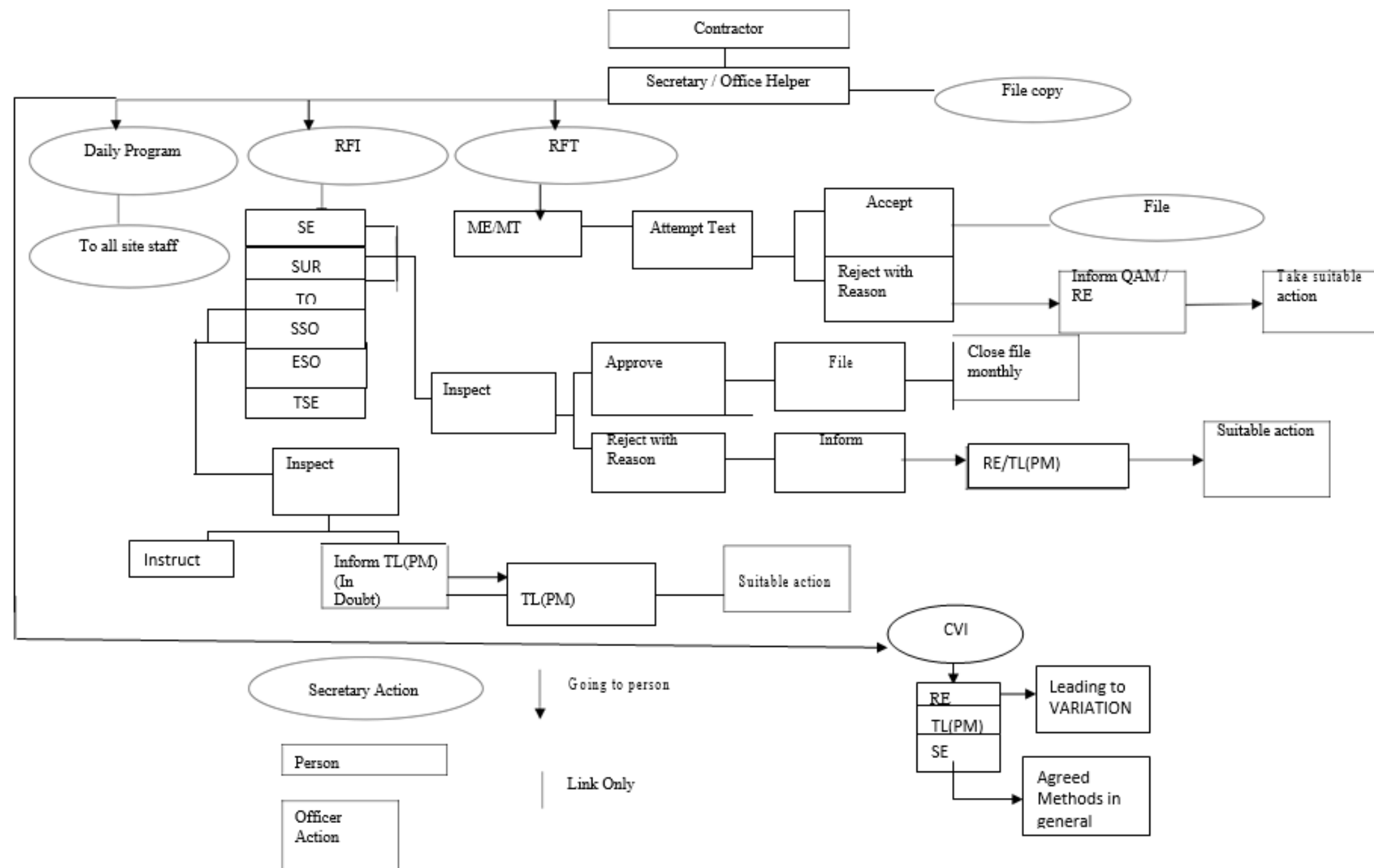


Appendix 4: Flow Chart for correspondents



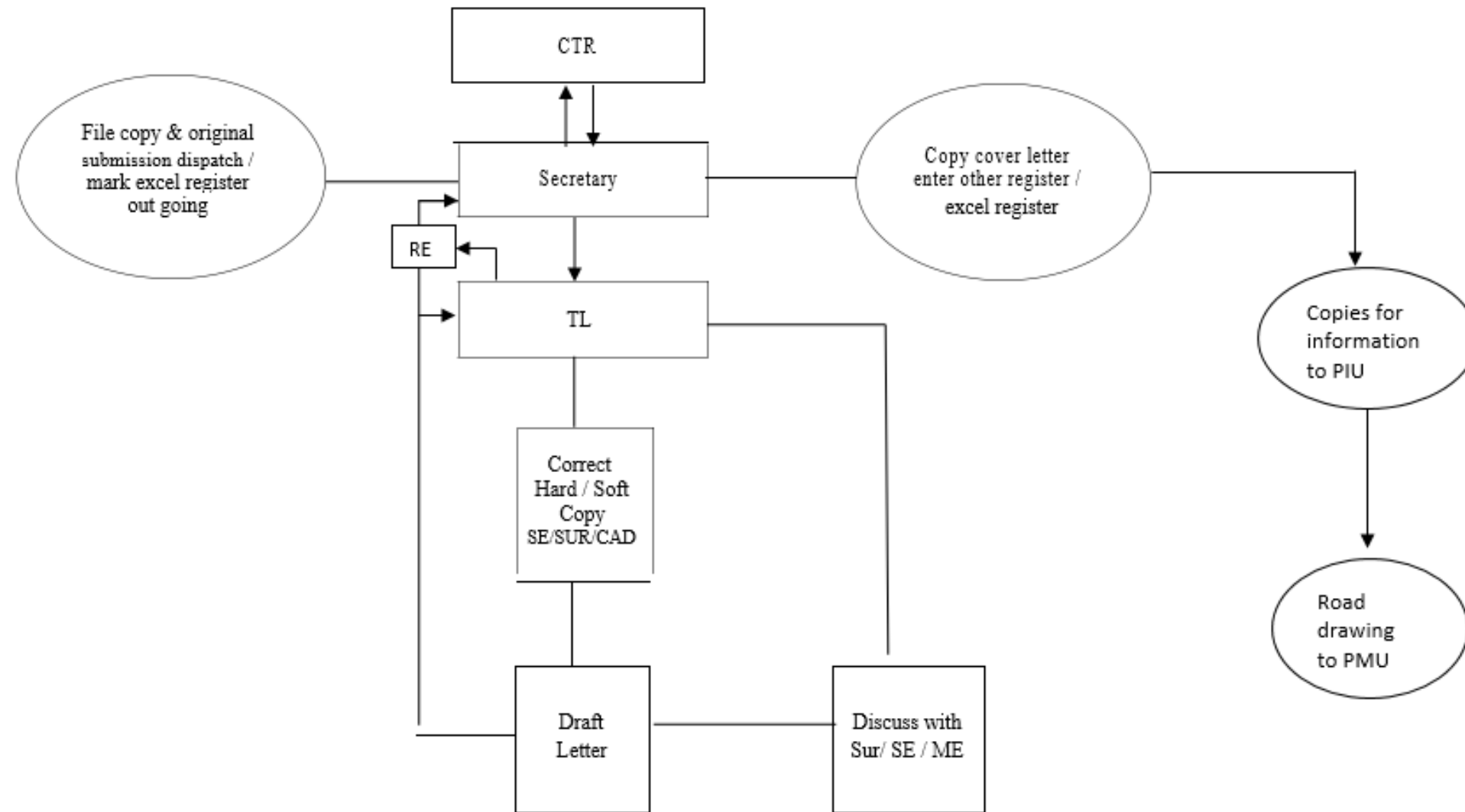


**Appendix 5: Flow chat for routine communication [Daily Program/RFI/RFT/Approvals]**



## Appendix 6: Flow chart for drawing approval

5. Road drawings
6. Structure drawings



## **Annexure – 4 - Draft Project Completion Report**

## **Draft Project Completion Report**

Project Number:

Loan Number:

Date:

Ministry of Local Government and Provincial Councils,

..... Project - Provincial Component

.....Province

### **CURRENCY EQUIVALENTS**

Currency Unit      –      Sri Lankan Rupee (SLRs)

		<b>At Appraisal</b>	<b>At Project Completion</b>
		14 July 2009	31 March xxxx
SLRe1.00	=	\$ 0.0087	\$ 0.0077
\$1.00	=	SLRs114.8599	SLRs130.180

## **ABBREVIATIONS and UNITS**

AADT	Annual average daily traffic
ADB	Asian Development Bank
CEA	Central Environmental Authority
CPS	Country partnership strategy
EA	Executing Agency
EIA	Environmental Impact Assessment
EIRR	Economic internal rate of return
EMP	Environmental Management Plan
GDP	Gross domestic product
GoSL	Government of Sri Lanka
HIV/AIDS	Human immunodeficiency virus/acquired immunodeficiency syndrome
IA	Implementing Agency
ICB	International Competitive Bidding
IEE	Initial Environmental Examination
JICA	Japan International Cooperation Agency
km	kilometre
LAR	Land acquisition and resettlement
LARP	Land and resettlement plan
MLGPC	Ministry of Local Government and Provincial Councils
NCB	National Competitive Bidding
PAM	Project Administration Memorandum
PBM	Performance-based maintenance
PCR	Project Completion Report
PIA	Project Impact Area
PIU	Project Implementation Unit

PMU	Project management Unit
PMIS	Project management information system
PPMS	Project performance management system
PPTA	Project preparatory technical assistance
ROW	Right-of-way
RRP	ADB's Report & Recommendation of the President to Board of Directors
RP	Resettlement Plan
RSDP	Road Sector Development Project
SDR	Special Drawing Rights
SIEE	Summary initial environmental examination
SGIA	Second-generation imprest account
SRP	Short resettlement plan
TA	Technical assistance
VOC	Vehicle operating cost

#### **NOTE{S}**

- (i) The fiscal year (FY) of the government of Sri Lanka and its agencies ends on 31 December. FY before a calendar year denotes the year in which the fiscal year ends, e.g. FY20.....ends on 31 December.....
- (ii) In this report, "\$" refers to US dollars unless otherwise stated.

Figure 1: Site Map of .....District Projects

Figure 2: Site Map of .....District Projects

## **BASIC DATA**

### **A. Loan Identification**

- |    |                  |   |
|----|------------------|---|
| 1. | Country          | Sri Lanka   |
| 2. | Loan Number      | .....   |
| 3. | Project Title    | ..... Project   |
| 4. | Borrower         | Democratic Socialist Republic of Sri Lanka                      |
| 5. | Executing Agency | Ministry of Local Government and<br>Provincial Councils (MLGPC) |
| 6. | Amount of Loan   | .....00.00  |

### **B. Loan Data**

- |    |                            |                   |
|----|----------------------------|-------------------|
| 1. | Appraisal                  |                   |
|    | – Date Started             | 22 April.....     |
|    | – Date Completed           | 30 April.....     |
| 2. | Loan Negotiations          |                   |
|    | – Date Started             | 8 July.....       |
|    | – Date Completed           | 8 July.....       |
| 3. | Date of Board Approval     | 16 September..... |
| 4. | Date of Loan Agreement     | 27 August.....    |
| 5. | Date of Loan Effectiveness |                   |



- In Loan Agreement 90 days after date of Loan Agreement
- Actual 13 November.....
- Number of Extensions None

6. Closing Date

- In Loan Agreement 30 June.....
- Actual 30 June.....
- Number of Extensions None

7. Terms of Loan

- Interest Rate 1% per year during the grace period and 1.5% thereafter
- Maturity (number of years) .....years
- Grace Period (number of years) ..... years

8. Terms of Relending (if any)

Not applicable

- Interest Rate
- Maturity (number of years)
- Grace Period (number of years)
- Second-Step Borrower

9. Disbursements

a. Dates

**Initial Disbursement**

**Final Disbursement**

**Time Interval**

29 December.....

{day month year}

{months}

Effective Date

Original Closing Date

Time Interval

13 November.....

30 June.....

.....months

b. Amount (SDR million) – with Amount Disbursed by NP to 31 March.....

Category or Sub-loan	Original Allocation	Last Revised Allocation	Amount Canceled	Net Amount Available	Amount Disbursed	Undisbursed Balance
1.Works	0.00			0.00	0.00	0.00
2.Equipment	0.00			0.00	0.00	0.00
3. Consultants	0.00			0.00	0.00	0.00
4. Project Management	0.00			0.00	0.00	0.00
5. Interest during implementation	0.00			0.00	0.00	
6. Unallocated	0.00			0.00	0.00	
<b>Total</b>	0.00			0.00	0.00	

10. Local Costs (Financed) – from .....Province accounts to 31 March.....

- Amount (\$ million) .....
- Percent of Local Costs 100.00%
- Percent of Total Cost 11.99%

**C. Project Data**

1. Project Cost (\$million) – Actual from .....Province accounts to 31 March.....

Cost	Appraisal Estimate	Actual
------	--------------------	--------

Foreign Exchange Cost	0.00	0.00
Local Currency Cost	0.00	0.00
<b>Total</b>	<b>0.00</b>	<b>0.00</b>

**2. Financing Plan (\$million) – Actual from .....Province accounts to 31 March.....**

<b>Cost</b>	<b>Appraisal Estimate</b>	<b>Actual</b>
Implementation Costs		
Borrower Financed	0.00	0.00
ADB Financed	0.00	0.00
Other External Financing	0.00	0.00
<b>Total</b>	<b>0.00</b>	<b>0.00</b>
IDC Costs		
Borrower Financed		
ADB Financed		
Other External Financing		
<b>Total</b>		

**3. Cost Breakdown by Project Component (\$ million) – Actual from .....Province accounts to 31 March.....**

<b>Component</b>	<b>Appraisal Estimate</b>	<b>Actual</b>
<b>A Base Cost</b>		
1. Road and Bridge Improvement	0.00	0.00
2. Project Management	0.00	0.00
- Project Implementation Consultant		
- Incremental Administrative Costs		
3. Northern Provincial Road Development	0.00	0.00
Department Office Improvements		

<b>Sub-Total A</b>	0.00	0.00
	0.00	0.00
<b>B. Taxes and Duties</b>	0.00	0.00
	0.00	0.00
<b>C. Contingencies</b>	0.00	0.00
<b>D. Financing Charges during Implementation</b>	0.00	0.00
<b>TOTAL</b>	0.00	0.00

---

*All above.... province accounts figures are interim, pending completion of final project payments.*

#### **4. Project Schedule**

<b>Item</b>	<b>Appraisal Estimate</b>	<b>Actual</b>
<b>Contract with Supervision Consultants</b>		
Date of Award	1 March.....	29 December.....
Completion of Work	13 December.....	30 June.....
<b>Civil Works Contracts</b>		
Date of Award Phase 1 Packages	1 April.....	13November .....to 17 June.....
Completion of Work	31 December.....	24 June.....
Date of Award Phase 2 Packages	1 July.....	10 March.....
Completion of Work	31 December.....	30 June.....
Performance Based Maintenance	1 July.....	14 September.....
Completion of Work	30 September.....	30 June.....

Other Milestones

---

#### **5. Project Performance Report Ratings**

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	Ratings	
	Development Objectives	Implementation Progress
<b>Implementation Period</b>		
From 26 Oct. ....to {day month year}		
From {day month year} to {day month year}		
From {day month year} to {day month year}		
From {day month year} to {day month year}		

## **I. PROJECT DESCRIPTION**

### **A. Objectives**

1. This report is limited to the..... Provincial Roads portion of the Project,
2. The rationale for the Road Rehabilitation Project, as defined in the Report and Recommendation of the President<sup>1</sup> was as described below.
3. The Project will improve connectivity in the provinces' transport networks. Improved roads—in conjunction with a range of other carefully coordinated measures proposed in the Country Partnership Strategy (CPS) and designed to strengthen administrative and absorptive capacity in poorer regions—will contribute to poverty reduction. By improving connectivity to neglected areas, the Project will support socially inclusive development. Therefore, because it will contribute to reducing disparities in Sri Lanka, the Project is in line with the CPS. The institutional capacities of the..... Province Road Development Department (PRDD) must be strengthened, particularly in planning, programming, and contract administration. The Project will also help strengthen their institutional capacity in road asset management.
4. Overall road sector management capacity in the Province will be enhanced by (i) modernizing the PRDD office, and (ii) improving the capacity of PRDD to manage their road assets.

### **B. Components**

5. The .....Road Connectivity Project (the Project) aimed to rehabilitate about .....kilometers (km) of provincial roads in the .....Province. The scope of work included strengthening pavement, and improving or replacing bridges, drainage and culverts as necessary.
6. Roads were selected from the long-list proposed by ..... of the provinces. The criteria for short-listing the roads included the role of the road in connecting economic and social services and national highways, traffic volume, road conditions, poverty index, and the importance of road to bus services see feasibility report !!! A feasibility study was then conducted, considering (i) engineering and traffic aspects, (ii) treatment options and cost estimates, (iii) social and environmental aspects, and (iv) economic internal rate of return. The final list of roads was validated in terms of distribution fairness among different ethnic groups.

---

7. About .....km of roads in..... Province were targeted to be rehabilitated<sup>2</sup>. The use of the existing road corridor is maximized to achieve the optimal combination of economy and desired road improvement without land acquisition. Double bituminous surface treatment is applied. Bridges and culverts are also rehabilitated and replaced as required. Particulars of each proposed and actual contract package are included in **Appendix 2**.
8. At appraisal it was decided that “**performance-based maintenance**” after completion will be included in the civil works contracts to secure maintenance of the project roads. Through the capacity development Technical Assistance (TA) project, PRDD road asset management systems will be strengthened for objective planning and budgeting. A 5-year rolling road maintenance plan will be developed. Vehicle license fee revenues will be dedicated to routine maintenance. Budgets will be gradually increased to meet maintenance requirements, and PRDD’s monitoring systems for implementation will minimize the risk of underutilizing these budgets.
9. **Enhancement of Project Management Capabilities** is also covered under a separate TA by provision of consulting services on 21 December ..... to support project implementation, hands-on training, strengthening the project management capacity of the PRDD.
10. **Improvement of PRDD Offices** is listed as an Output in the Design and Monitoring Framework, and a RRP Base Cost provision of \$..... million was provided in the Project Investment Plan<sup>3</sup>.

### C. Implementation Methods

11. The Borrower designated the Ministry of Local Government and Provincial Councils (MLGPC) as the Project Executing Agency (EA) with overall responsibility for Project coordination at the central level, including provision of policy and technical guidance and interagency coordination. MLGPC undertook these activities through the existing project coordinating unit established under ..... Loans .... - SRI: ..... Sector Development Project and .....-SRI: Road Project Preparatory Facility. The Project Coordinating Unit (PCU) is led by a Project coordinator, assisted by a chief accountant, an office engineer, and support staff.
12. ....Provincial Council (PC) through PRDD, act as the implementing agencies with primary responsibility for project management, including - without limitation:
  - (i) procurement;
  - (ii) day-to-day project implementation;

---

<sup>2</sup> In .....Province, the Project targets roads in ..... districts, totaling approximately 150 km in length, .

<sup>3</sup>Refer to RRP Table 1 ‘Project Investment Plan’ (also included in this PCR in **Appendix 12**) and Appendix 1 ‘Design and Monitoring Framework’ (also included in this PCR in **Appendix 1**).

- (iii) withdrawal applications certification;
- (iv) progress reports preparation; and
- (v) maintenance of project accounts and completion of loan financial records for auditing for the respective provinces.

13. .... is led by the Provincial Director, assisted by a Chief Engineer–..... Chief Engineer–..... Chief Accountant, an Office Engineer, and support staff.

14. The Borrower established a National Steering Committee (NSC), responsible for overseeing and monitoring implementation of the Project and monitoring the adequacy of overall funding for the Project and for non-Project roads. The NSC is chaired by the Secretary of MLGPC, and consists of representatives from: Ministry of Finance and Planning (External Resource Department and National Planning Department); Finance Commission; Ministry of Highways and Road Development; Chief Secretaries of relevant provincial councils ....PC and ...PC, ..PRDD, ...PRDA, and the PCU, and by invitation, as and when necessary, representatives from the Central Environmental Authority (CEA), Geological Survey and Mines Bureau, and utilities agencies (electricity, telecommunications, water, and drainage). It was intended that the NSC would meet quarterly.

15. ....PC established Provincial Coordination Committees (PCC), responsible for monitoring project implementation at the provincial level. The PCC is chaired by the Chief Secretary of the respective province, and consists of a representative from NPRDD, the project implementation consultant (ex officio non-voting) of the respective province, and by invitation, as and when necessary, the CEA, Geological Survey and Mines Bureau, utilities agencies (electricity, telecommunications, water, and drainage). It was intended that the PCC would meet every three (3) months. Details of the Northern Province Project Management Organization structure and actual coordination meetings held are contained in PCR **Appendices 3 and 4**.

**D. Description and Justification of Changes** in components (or sub project appraisal criteria) or implementation methods

16. The table of indicative contract packages included in RRP Appendix 5 totals .....km for..... Province. **PCR Appendix 2** provides a comparison of these indicative packages with the actually implemented thirteen (13) road contract packages totaling .....km (i.e. +9.5%), plus one (01) building contract.

17. Rather than performance-based network maintenance with specified compliance criteria, procedures and penalties, each awarded contract requires the construction contractor to provide routine maintenance for three (5) years from the date of receipt of the Taking-



Over Certificate. Issues related to this change are discussed in Section C 'Implementation Methods' below.

18. Project Implementation Consultant (PIC) contract for supervision services in .....Province was awarded on 21 December..... Services commenced in January ..... for an expected duration of 27 months ending March..... As a result of the delayed award of Phase 1 Contracts..... and ....., implementation delays and additional work, services were actually extended to August 2013 and then June ..... for a total duration of 54 months to allow for the extended construction duration. Refer to **Appendix 11** for further details.
19. RRP Table 1 Project Investment Plan provision of \$..... million for..... Provincial Road Development Office Improvement” was reallocated in the PAM Annex 6 Cost Estimate. Construction of new office buildings in..... for the PRDD Provincial Project Director Refer to **Appendix 12, Table A** for further details.

## II. PROJECT IMPLEMENTATION

- A. Comparison of original vs. actual implementation schedules. Indicating delays, length and causes of delays, and remedial action taken.
20. Design and Monitoring Framework Output 1 targets the rehabilitation of approximately .....km of roads with related structures in Northern Province. **Table 1** below compares this target with the .....Km of roads, and one PRDD office building and additional buildings and renovations for Divisional offices of PRDD in..... and..... actually executed under the project, and lists the relevant work phase, location, contractor, and award date for each contract package. Also refer to **Appendix 2** for details of the specific roads involved.
21. **Appendix 5** provides a diagrammatic comparison of the proposed execution plan from PAM Annex 7 with actual implementation, while **Appendix 6** gives basic data for each contract package.
22. Phase 1 Procurement was scheduled to commence at the start of April ....., and was actually closed on 12 May..... And the award of initial Phase 1 contracts projects 01, 02, 03, 04, 05 & 06 were on 26 October..... [see table 1]
23. Phase 2 [fund saving] was scheduled to commence .....? [find from PPD office] Actual procurements were done in ....., .....,....., and awards were made on 20-Feb.15, 19-Jan.15 and 09- Apr.15for P07, P09 and P02R [see table 1]

**Table 1: Particulars of construction contracts**

Contract Package	Road No.	Location	Length (Km.)	Name of Contractor	Scheduled Award Date	Actual Award Date

24. Fence removal of encroached places [P01, Public protest for use of their paddy lands in road widening [P02] relocation of Army camp [P06] were raised by the respective contractors. Meetings with relevant officers were held and matters were sorted out. Army camp shifting took time until they made new semi-permanent buildings. This was completed before the contractor completed the work in the adjacent kilometer. In P01 a column in a Kovil was an obstruction for widening. Considering the feelings of the devotees, the road alignment had been slightly adjusted
25. Some contractors had correspondence of delay in interim payments that would affect their rate of progress, however this issue was overcome and no claims for interest on delayed payment or default notices were received.
26. P01 and P03 contractors had reported shortages of cement and bitumen in August ....., as notice of claim. But these were not followed later by them.
27. In June..... grievance redress committees [GRC] were established for all contracts
28. In September progress reports it had been reported that all are behind schedule from their approved construction programs. The contractors had been instructed to revise construction programs by the Engineer.
29. HIV/AIDS awareness programs had been conducted one in..... in April ..... and the other in ..... in June..... for the staff and workers of the contractor with the Employer and Engineer representatives participating.
30. Engineer has recommended to the Employer to give termination notice to contractors of P05 and P06 due to low progress in September.....

31. Part taking over has been started from ..... to ..... in contracts P01; from 21 Nov..... to 01 Jun..... in contract P03; from 09 Oct. .... to 28 Feb. .... in contract P04; and from 03 Jan ..... to 31 May..... in contract P05.
32. Contractor of P04 had been instructed to investigate and correct surface damage of roads C 034 and 029 in April .....; similarly, for P03 in August.....
33. At a special meeting held in /Colombo ministry office in March ....., it was decided to give EOT on ex-gratia basis to contractors of P 03, 04, 05 and 06 on signing of a Memorandum of Understanding [MOU] with conditions that no delay damages will be imposed and the contractors will not make any new or extra claims to the Employer. All work items to be completed by end May..... MOU were signed on 02 April.....
34. Also, it was agreed by the parties to terminate contract P02 on mutual understanding without any cost claims to either party and measurement were jointly taken in April
35. To take advantage of available loan funds, tenders were called for additional Phase 2 contract packages P07, P09 and P02R. Contract No. P07 is the building for PRDD office, P09 is a road in ..... - the furthest end of .....road, which was done under P05 for..... km in ..... district and P02 R is the balance work of P02 – the terminated contract.
36. Extensions of time were awarded for unusual weather, delay in payment of mobilization advance [for P09 & P02R] and additional work where it affected the program critical path. Table 3 below provides an overall summary of extensions of time granted and any further time required by contractors to achieve Taking-Over of the Works. In addition **Appendix 7** provides more specific 'Time' information for each contract package.

**Table 3: Time for Completion**

Contract Package	Date of Commencement	Original Contract Period (months)	Original Scheduled Completion Date	EOT Due to Additional Work/Weather (months)	Additional Time to Complete (months)	Actual Date of <u>final</u> Taking Over	Remarks
<b>Phase 1 &amp; 2 [fund savings]</b>							

- B. Compare cost estimates made during appraisal and actual costs (foreign and local). Local currency costs incurred, appropriate exchange rates for their conversion into US dollars, and the foreign exchange costs financed by co-financiers must be compiled correctly with reference to audited project accounts. Indicate factors that contributed to any significant overruns or under-runs.

37. **Table 4** below summarizes current civil works cost estimates for each contract package. The overall current estimate is below the sum of Accepted Contract Amounts (ACA) by .....2%, which is much more than the total .....% of ACA value of routine maintenance. Final contract costs cannot be determined in June .....until the five (5) year routine maintenance is completed in all phase 1 contracts, and disagreement by contractor for P03, 04 and 05 is settled. ADB funding of routine maintenance will cease with the loan closing date.

**Table 4: Civil Works Costs**

Contract Package	Location / District	Contract Value with VAT 12% (LKR)	Contract Value excluding VAT (LKR)	Forecast Final Sum excluding VAT (LKR)	Saving excluding VAT (LKR) as on 31 March 2017
<b>Totals</b>					
hase 2 [fund saving]					
<b>Totals</b>					
Note: Total payment includes part of PBM payments. Exact values of PBM payments are known to PRDD. Savings are calculated by deducting payment including PBM as on 31 March, from the contract sum					

38. No equipment costs have been allocated by PRDD?, with the cost of new office buildings being included under civil works.

39. Consultancy costs increased marginally from the original consultancy contract value by the equivalent of \$..... (or ..... %) as a result of extensions given to the contractors. The extra costs involved in work done later in phase 2 [fund saving] were paid under NRCP – Additional finance agreement for the consultancy. Refer to **Appendix 11** for further details.

- C. Difficulties in recruiting consultants, with reference to ....Bank procedures. Assess the consultant's work and the working relationship between the executing agency (EA) and the consultant. Use of a design and monitoring framework is strongly recommended.

***MLGPC to add further comments.***

40. With reference to the Project Design and Monitoring Framework contained in **Appendix 1**:


- “Outputs” target was the rehabilitation of approximately.....km of roads and related structures in .....Province – .....km of road and related structures were actually rehabilitated as detailed in Engineer’s progress reports and this PCR.
- Milestones;
  - Phase 1 civil work contract award by October..... – actual awards were November..... to June .....,
  - Phase 2 civil work contract award by March ..... – actual awards were January ..... to March .....,
  - Completion of all construction and maintenance works by December ..... – now due for completion by June ....., and
  - Engagement of project implementation consultant by October..... – actual contract signing was in December.....

- D. State problems or difficulties encountered in procuring goods and services (including civil works) with reference to ..... procedures. Assess the supplier's or contractor's performance under the contract.

41. No problems or difficulties were experienced in following ADB procurement procedures. However, contract award and implementation delays and changes did occur as discussed in paragraphs 23 to 33 above, plus some implementation delays occurred as a result of inadequate contractor performance as discussed further below. **Gravel problem**

42. With the exception of contracts P01 contractors were generally slow to mobilize and carry out the initial contract formalities of;
- Submitting acceptable securities and insurances,
  - Nominating and obtaining the Engineer's approval of a Contractor's Representative to continue to the end of the project,
  - Preparing, submitting and obtaining the Engineer's approval of a Work Program, supported by activity Method Statements and with a related Cash Flow,
  - Preparing and submitting their Quality Assurance System,
  - Preparing, submitting and obtaining approval of an Environmental Management Action Plan, and
  - Carrying out necessary survey and design work before construction could commence.
  - Obtaining approvals and relocation of utilities at some locations
43. With the recent emergence of Northern Province from prolonged conflict and with alternative opportunities for work in other parts of the country, contractors starting work in year ..... had difficulties in recruiting staff and finding local accommodation. In addition the commencement of work coincided with an extended Sri Lankan New Year period that also involved a Presidential election in January ..... and a parliamentary election in April.....
44. The execution of Phase 2 contract packages P02R P07 and P09 was delayed by lack of effective contractor planning, and execution of DBST work. However these contractors managed with FIDIC and contract procedures, although they did not appear to fully appreciate the consequences of late completion.
45. Overall contractor performance is summarized below, with more detailed analysis provided in **Appendix 10**.

**Table 5: Assessed Contractor Performance - PIU & PCU may change**



Contractor	Summary Assessment	Contract(s)
	Satisfactory performer bu noncooperative	
	Bad performer	
	Bad performer	
	Bad performer	
	Bad performer	

	Poor performer but cooperative	
	Poor performer but cooperative	
	Very Poor performer but cooperative	
	Poor performer; but cooperative	

- E. Give the extent of compliance of the borrower and EA with loan covenants<sup>4</sup>, with reasons for noncompliance or delays in compliance and the remedial actions taken.

46. Sector Covenants

**Implementation Arrangements** involving the Project Executing Agency, Implementing Agencies, National Steering Committee and Provincial Coordination Committees have been fully complied with.

**Road Maintenance and Rehabilitation** arrangements are considered to have been successful for Northern Province rehabilitation work, but initial three (5) year road maintenance through civil works contractors has not been completed to-date.

***MLGPC to add further comments on all Borrower covenant requirements.***

**Institutional Strengthening**

.....add

***MLGPC to add comments on this Borrower covenant.***

47. Financial Covenants

**Counterpart Support**

***MLGPC to add comments on this Borrower covenant.***

48. Environment Covenants

**Environment**

- (i) The Project has been undertaken in accordance with the Borrower's applicable laws and regulations and ADB's Environment Policy (2002);
- (ii) The EMP has been implemented in accordance with its terms so that all adverse environmental impacts during construction of the Project are mitigated – ***this statement needs to be updated by MLGPC for operation of the whole Project in due course;***
- (iii) No changes in the Project design that have had significant environmental impacts have occurred in..... Province, therefore an additional

<sup>4</sup> Loan Agreement 22 October ..... between Democratic Socialist Republic of Sri Lanka and .....

environmental study has not been required – ***this statement needs to be updated by MLGPC for operation of the whole Project in due course;***

- (iv) The IEE and EMP has remained relevant during the course of Project implementation in..... Province and has not required updating – ***this statement needs to be updated by MLGPC for operation of the whole Project in due course;***
- (v) Reports on the implementation of the EMP are submitted to ADB on -annual basis - ***this statement requires MLGPC confirmation;***
- (vi) Bidding documents for Works under the Project in..... Province included the summary IEE and EMP, contractors awarded work were required to produce approved Environmental Management Action Plans prior to commencing work, and compliance has been monitored throughout construction as confirmed in implementation consultant monthly reports.

#### 49. Social Covenants

##### **Land Acquisition and Resettlement**

Construction activities of the Project in..... Province have been restricted to the existing Right of Way (ROW) and no land acquisition has been required.

##### **Construction Labor**

Bidding documents and resulting conformed contract documents include provisions requiring contractors to (i) provide appropriate information and create awareness among construction workers on the risks of sexually transmitted diseases and HIV/AIDS, (ii) provide safe and healthy working conditions, including appropriate sanitation facilities for women workers, and (iii) comply with all applicable labor laws, provide equal pay for equal work, prohibit the employment of child labor, provide appropriate facilities for the children of construction workers in construction campsites, and provide equal opportunities for women and men in construction activities.

#### 50. Other Covenants

##### **Grievance Redress Mechanism [PIU knows this in detail]**

Committees were established to address any Project-related concerns raised by project road users and communities along Project roads in Northern Province. The Project has received broad community support, and implementation consultant monthly reports confirm that no complaints have been received to-date.



## Governance

- (a) All contracts financed by ..... in connection with the Project include provisions specifying the right of ..... to audit and examine the records and accounts of implementing agencies, contractors, suppliers?, consultants and other service providers as they relate to the Project.
- (b) The EA has established a Project Performance Monitoring and Evaluation system. ***MLGPC to comment on public disclosure of Project targets, progress and achievements at ...PRDD and ...PRDA head offices, construction site and their websites.***
- (c) All road rehabilitation and maintenance works, in Northern Province have been outsourced to the private sector. ***This statement needs to be updated by MLGPC in due course to cover all maintenance works.***
- (d) ..... province procurement has not been restricted by contractor registration rules.
- (e) Standardized FIDIC bidding documents have been used and FIDIC-based contract management implemented in Northern Province.

## Reporting

- (a) The Northern Province Implementation Consultant has submitted timely Monthly Progress Reports to PRDD since February 2011. ***PC to confirm submission of Monthly Progress Reports to MLGPC and ....; and***
- (b) ***PC to confirm submission of Quarterly Progress Reports to MLGPC and ...; and***
- (c) ***This report provides..... Province Implementation Consultant Project Completion Report input to the MLGPC.***

## Project Performance Monitoring and Evaluation

Implementation of the Project Management Information System was initially delayed until a specialist consultant was employed under a Variation Order to the..... Province Implementation Consultant contract to prepare baseline indicators - in conjunction with the information extracted from the feasibility study and design report<sup>5</sup>. The PPMS report has been included in **Appendix 13**.

## Project Review

***MLGPC and PC to comment on annual Project reviews.***

- F. State reasons for any delays in loan utilization. Evaluate the appropriateness of the disbursement methods used. Justify the reallocation of loan proceeds.

### 51. ***MLGPC and PC to comment***

---

<sup>5</sup>August ..... Bank Loan .....: Road Project Preparatory Facility  
Consulting Services for Feasibility Study and Detailed Engineering Design of Provincial Roads

- G. State problems or difficulties with sub project appraisal. Evaluate the EA's performance and capacity to appraise subprojects.
- 52. ***MLGPC and PC to comment***

### III. INITIAL OPERATIONS

- A. Describe initial operations of the project and transitional problems encountered from project completion to initial operations.
- 53. ***MLGPC comment on routine maintenance and any other initial operation issues.***
- B. Describe measures taken to ensure continued smooth operation of the project relative to management, staffing, funding, and maintenance of project facilities.
- 54. ***MLGPC and PC to comment***
- C. Analyze the prospects of the project benefits being realized.
- 55. The project has enjoyed broad community support in..... Province though the direct short-term employment of labor and involvement of local suppliers, plus the longer-term improvement of..... km of the provincial road network, plus the additional experience gained officers working on international standard development projects. ***MLGPC and PC to add further comment on road maintenance and long-term benefit.***

### IV. EVALUATION OF THE ASIAN DEVELOPMENT BANK'S PERFORMANCE

- A. Assess ....'s performance in supervising project implementation. Include comments on the adequacy of the consultants' terms of reference and appropriateness of specifications in tender documents. Evaluate the effectiveness and timeliness of assistance extended by ....to solve implementation problems. This is for Employer to complete?
- 56. .... provided clear guidance, appropriate documentation, valuable support and timely assistance to the Project. ***MLGPC to add further comment.***

- B. Comment on problems encountered with ....'s procedures. Note the measures taken to resolve these problems and suggest changes in procedures and requirements. This is for Employer to complete?

57. ***MLGPC to provide comment.***

Beyond TL office



**Appendix 1**

**PROJECT DESIGN AND MONITORING FRAMEWORK**

(2 pages)

[PEC and PCU to prepare jointly]

Design Summary	Performance Targets and/or Indicators	Data Sources and/or Reporting Mechanisms	Assumptions and Risks
<b>Impact</b>  Improved transport system in Sri Lanka	By year.....  ..... km of national highways and ..... km of provincial roads upgraded and rehabilitated	Annual report of the Central Bank of Sri Lanka  Publications of the Ministry of Highways and Road Development  Publication of the Ministry of Local Government and Provincial Councils  Development plans of the Ministry of	<b>Assumptions</b>  Policy directions of the Government's 10 Year Development Framework will remain valid.  Conflict situation is gradually resolved.  <b>Risk</b>  Government investments are not adequate.

		Finance and Planning	
<b>Outcome</b>  Improved road network in..... and..... Provinces              Improved institutional capacity	By project completion: Vehicle operating costs reduced by 30% in..... Province and 20% in .....Province   Travel time reduced by 50% in .....Province and 30% in..... Province.   PRDD and PRDA are restructured and staffed, and training program implemented.	National Planning Department, Ministry of Finance and Planning   PRDD's and PRDA's completion reports   Job descriptions and staff performance reports	<b>Assumption</b>  Conflict situation  Is gradually resolved   <b>Risk</b>  Funding for maintenance is inadequate.
<b>Outputs</b>  1. Provincial roads are rehabilitated and improved, and selected bridge links are rehabilitated and replaced.	By project completion:  Approximately ..... km of roads in..... Province and .....km roads in ....province are rehabilitated.  Nineteen bridges and culverts in..... Province and 24 in	Engineer's progress reports   Audit reports   PRDD's and PRDA's project progress and	<b>Assumption</b>  Qualified contractors are available.   <b>Risk</b>  Turnover of qualified trained staff is high.

2. PRDD and PRDA project management capability is enhanced.	.....Province are rehabilitated and replaced.	completion reports	
3. PRDD's office is improved.	Five staff for each of PRDD and PRDA are provided with on-the-job training with extensive hands-on project management skills.		
	PRDD's offices in ..... and ..... are improved.		
<b>Activities with Milestones</b>  <b>1. Roads, Bridges, and PRDD Office Rehabilitation and Improvement</b> 1.1 Contract award of civil works (phase 1) by October..... 1.2 Contract award of civil works (phase 2) by March..... 1.3 Completion of all construction and maintenance works by December.....  <b>2. Project Management</b> 2.1 Engagement of project implementation consultant by October..... 2.2 Project management on-the-job training completed by June.....  <b>3. Institutional Capacity Development</b> 3.1 Engagement of CDTA consultant by March..... 3.2 Preparation of capacity development plan, including organizational improvements, staffing allocation and			<b>Inputs</b>  <b>For 1 and 2:</b> ADB: \$..... million Government: \$....million          <b>For 3:</b> ADB: \$..... Government: \$..... in-kind

<p>assignments, training programs, and MIS requirements by June.....</p> <p>3.3 Establishment of simple MIS consisting of peer-to-peer office local area network, basic office software, and PRDD website by July.....</p> <p>3.4 Development of functioning road maintenance management system with completed provincial inventory and visual conditions data with base map by March.....</p> <p>3.5 Annual maintenance works program by May.....</p> <p>3.6 Preparation of an objective road maintenance budget application for FY..... onward by June.....</p> <p>3.7 Preparation of 3-year rolling road investment plans (20...–20....) by August.....</p>	
--	--

Source; .....Bank PAM December.....

PRDD = Provincial Road Development Department,

PRDA = Provincial Road Development Authority.

## Appendix 2

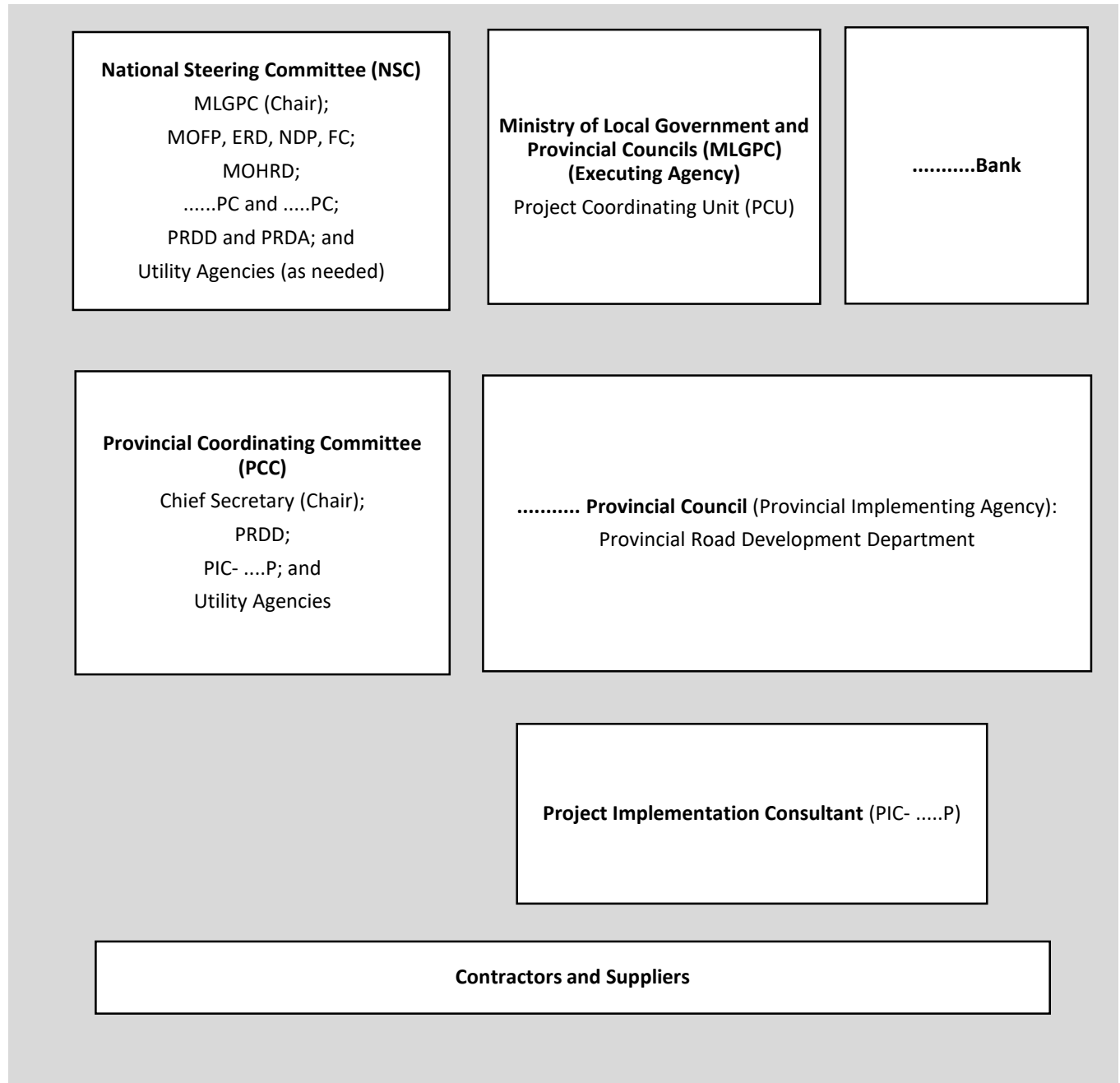
### ..... PROVINCE CONTRACT PACKAGES

Package	District	Road No.	Road Name	At Inception	Actual	
				Length (km)	Road Length (km)	Package Length (km)
1. Phase 1 Roads						
P 01						
P02						
Total length of roads					--	



### Appendix 3

#### ..... PROVINCE PROJECT MANAGEMENT ORGANIZATION STRUCTURE



## Appendix 4

### ..... MISSIONS DURING IMPLEMENTATION

..... Missions visited site to monitor project status;

- From 25 to 29 October.....
- From 18 to 20 October ....., and
- From 04 to 06 December.....

### ..... PROVINCE PROJECT COORDINATION MEETINGS

NSCM = National Steering Committee Meeting

PCCM = Provincial Coordination Committee Meeting

Date	Reference No.	Venue	No. of Attendees
<b>National Steering Committee Meetings</b>			
04 Jul.....	04	MLGPC Auditorium, Colombo	24
04 Oct. ....	05		24
09 Mar.....	06		23
18 Jun. ....	07		29
03 Aug.....	08		23
10 Apr. ....	09		25

<b>Provincial coordinating committee meetings</b>			
<ul style="list-style-type: none"> <li>• First PCC meetings were held in .....province.</li> <li>• There has been no participation from this office of PIC</li> </ul>			
Date	Reference No.	Venue	No. of Attendees
05 Jul.....	12	....PC conference hall Library.....	30
03 Dec....	13		42
14 Mar.....	14		33
16 Jun.....	15	Conference hall ACLG office.....	28
30 Sep.....	16	...PC conference hall Library.....	44

..... PROVINCE CONTRACT IMPLEMENTATION CHART

[illegible]

Contract	start	End	20....					20....					20....					20...							
P01	10/02/20.. ...	21/06/20.. ...	x	x	x	x	x	x	x	x	x	x	x	x	x	x									
P02	11/02/20.. ..	<b>30/04/20.. ...</b>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
P03	10/02/20.. ..	31/05/20.. ...	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				

Phase 2 [fund saving]

Contract	start	End	2014					2015					2016					2017				

[illegible]

**Employer to correct**

## Appendix 6

### ..... PROVINCE CONTRACT IMPLEMENTATION DETAILS

#### 1. Pre-construction stage [to be prepared with the help of PCU office Colombo]


#### 2. Construction stage

Package / District	Contract works	Changes to original works	Remarks
P01 / .....	04 roads of lengths varying from.... km to ... km totaling to..... km and.... Culverts [.... new; ... widening & rest repair]	Road length decreased to..... km on completion with no changes in culverts	Change was required because of assessment error
<b>Commencement and final taking over</b>	<ul style="list-style-type: none"> <li>VOs: Concrete paving in an inundating section during rainy season in one road and a few repair culverts were improved</li> <li>Issues – Taking over of Pe.... – Va..... road was delayed for loss of DBST aggregates in a few hundred meter length; --</li> <li>Claims accepted: prolongation cost</li> </ul>		
10/02/20....			
21/06/20.....			
Package / District	Contract works	Changes to original works	Remarks
P02 / .....	01 road of length ..... km and.... Culverts [.. re-construction and the rest widening]	Road length increased to ..... km on completion. ....No culverts and 01bridge were added	Changes were required because the two villages in the two ends were connected. And lot of irrigation culverts were required as the road crossed minor irrigation schemes. The bridge on LB canal of the..... Oya anicut known in the area as ..... was not in good condition and was replaced by a new bridge with improved alignment of the road
<b>Commencement and final taking over</b>	<ul style="list-style-type: none"> <li>VOs : on excessive quantity changes or change of nature of work; redoing c/s works;</li> <li>Issues: Public complaint of using paddy are for road widening; the matter was settled by having meetings with them, agrarian services and the Employer; ---Requests from farmers and agrarian services for more irrigation canal culverts across the road; these were allowed and the</li> </ul>		
11/02/.....			

30/04/20.....	<p>number of structures increased remarkably; ---- Low progress was adjusted by having many review meetings and putting contractor under pressure, but was not of much success; --- substantial increase of tree removal and earth work was observed and even road levels were revised to economize on quantities and EOT had been allowed; ---</p> <ul style="list-style-type: none"> <li>• Claims: EOT was given on weather and quantity increase for tree removal and culverts</li> <li>• Termination on mutual understanding: In December 20... the contractor was paid nearly 90% of cost except P. Sum, and contingencies and day works but the actual work was much less due to quantity increase in tree removal and culvert construction. Until extra funds were approved there was a question of paying as well as the rate of progress of the contractor. So the parties agreed to terminate the contract on mutual understanding without any cost claim from either party</li> </ul>		
Package / District	Contract works	Changes to original works	Remarks
P03 / .....	..... roads of lengths varying from .....km to ... km totaling to ..... km and 08 Culverts [03 reconstruction and the rest- repairs as needed] and 01 [cell type] bridge and ....causeways	Road length decreased to ..... km on completion. ....culverts added	Changes were required due to curve improvement and assessment error in the original proposal
<b>Commencement and final taking over</b>	<ul style="list-style-type: none"> <li>• VO's: on excessive quantity changes or change of nature of work;</li> <li>• Issues: Lack of resources, non- availability of key staff of required caliber and low progress were observed and the contractor has been requested repeatedly to correct the situation; --- Officer turnover has been common; Cement and bitumen shortages have been reported by the contractor but these were short term and localized, No claim had been submitted for delay on this; --- places in many roads were observed damaged after completion and the contractor rectified at his cost; ---- Employer was eligible for delay damages but did not impose it and pushed the contractor to complete the work considering his poor cash flow which will be further affected; --- Later an expert report was required to assess the reason for damage but the report was not conclusive and the report was received after the agreed date</li> <li>• Notice to correct</li> <li>• Claims accepted: Additional cost of extended bonds</li> <li>• Claims rejected/disputed: New rate for embankment and sub base filling; pre-coating of DBST aggregate; revised cost of price escalation due to quantity variation; cost of the investigation report to find the reason of base failure of completed roads</li> </ul>		
10/02/20.....			
31/05/20.....			
10/06/20..... 06/10/20.....			

3. Performance based maintenance stage [to be filled by the Employer]


## Appendix 7

### INDIVIDUAL CONTRACT SUMMARY SHEETS

Contract No./ District	Contractor	Total Actual Road Length (km)	construction period [months]		Accepted Contract Amount [ACA] Except PBM amount (LKR)	PBM BOQ amount for 5 years (LKR)	Final contract value except PBM
			original	Actual			

**Notes:**

1. P02 contract was terminated on mutual understanding. Thus performance based maintenance was not done. The balance work items were awarded as P02R
2. Bold figures are **not final** as work to be completed in DNP need to be paid
3. Bold italic figures are to be increased if the claims are to be paid after arbitration

## Appendix 8

### INDIVIDUAL CONTRACT QUALITY ASSURANCE SUMMARIES

Following tests were carried out in all contracts

Tests carried out	frequency	corrections
Material selection / approval		
For soils		
Sieve analysis	For every selection of source and any doubt of a change of properties from appearance	Select new source
Plastic and liquid limits		
density		
Maximum dry density		
CBR		
For Aggregates		
Sieve analysis	at selection of quarry and as specified	Adjust the crusher jaws/cones and retest until satisfactory
Impact value	at selection of quarry	Change the source
abrasion		
density		
flakiness		
CBR		
At construction stage		
Field density	minimum specified or one per day's work	re-compact/scarify and re-compact/remove and re-do
cube strength for concrete		Non destructive test
Tray tests for DBST		remove and re-do
Core/Marshall tests for asphalt		
If tests were found unsatisfactory, the work was redone and retested by the contractor. If not, Non Conformance Reports [NCR] were issued. No payments were made until correction is done		

NCR and corrections

Contract	No issued	Corrected	Unattended & not paid	Remarks
P01	records at Employer's office; sent with all the files			
P02	03	03		
P03				
P04	07	07	00	
P05	03	03	00	



**Employer to correct**

## Appendix 9

### BILL NO.8 [performance based] MAINTENANCE ROAD CONTRACT PROVISIONS

Contract No.	Contractor	Total Actual Road Length (km)	Accepted Contract Amount [ACA] Except PBM amount (LKR)	Bill No.8 Provision for 5 Year Maintenance (LKR)	Maintenance as % of ACA
P01					1.27
P02					0.78
P03					0.79
P04					1.26
<b>Overall</b>					<b>1.21%</b>
<b>Note:</b> P02 contract was terminated on mutual understanding. Thus performance based maintenance was not done. The balance work items were awarded as P02R					

#### Observations:

- i. All contractors were instructed to commence routine maintenance upon Taking-Over of the Works. Meetings with power point presentations were held to stress contractor maintenance obligations in the contracts, and reminder notices have been issued.
- ii. At the beginning no contractor was satisfactorily carrying out routine maintenance works. All contractors from Western province, found supervision of this minor work a costly affair. They were encouraged to select local contractor as the sub- contractor but for all contractual matters and monthly meetings a representative from the company was required. ....from..... province had no such problem
- iii. The PBM work by P01 contractor was found not attended for months and special meeting was called with them and he matters were straightened.
- iv. The above maintenance provision figures demonstrate that most contractors have provided minimal amounts for routine maintenance work after Taking-Over, possibly because they wanted to keep their bid price low to be awarded the contract and/or did not fully appreciate the work that would be required.
- v. Contractors of P09 and P02R were paid for some works for which NCR had been issued on special bonds given by the contractors; items are Asphalt and turf. These are to be completed satisfactorily during DNP/PBM period if ever defects are observed

- vi. At the time of Appraisal, performance-based maintenance (PBM) was proposed for this project. PBM is successfully used in countries around the world for private-sector maintenance of road networks. Usually, such networks are many hundreds of kilometers in length to encourage the contractor to invest in resources and planning for effective maintenance management over a long-term contract. The contractor is paid a fixed amount per kilometer per month, subject to specified penalties for non-compliance with listed performance criteria.
- vii. For this project, all road contracts except the building contract require contractors to carry out routine maintenance of roads for a period of five years after receipt of the Taking-Over certificate. Specific maintenance activities are listed, but no performance criteria have been specified. Because most of the required maintenance is to be done after Taking-Over and the 12 months Defects Notification Period, the only effective action that can be taken for non-conformance is considered to be termination under GCC Clause 15. In the event of termination, the relevant contractor will not be paid for routine maintenance work not done, MLGPC will be responsibility for funding routine maintenance, and the PRDD will be responsible for implementing routine maintenance.

Recommendations that can be drawn from the above are;

- (a) Where contractors are being asked to maintain roads after construction, greater attention must be given to contractor routine maintenance bid prices and experience when considering award of contracts,
- (b) Local contractors appear more likely to carry out routine maintenance than major construction contractors who are not locally based,

## Appendix 10

### CONTRACTOR PERFORMANCE ASSESSMENTS

All contractors have been slow to mobilize and complete initial contract formalities, including;

- i. Satisfactory submission to the Employer of Securities and Insurances,
- ii. Nomination and Engineer's approval of the Contractor's Representative,
- iii. Submission and Engineer's approval of the Works Program with activity Method Statements and related Cash Flow,
- iv. Submission of acceptable Quality Assurance System details,
- v. Submission of an acceptable Environmental Management Action Plan, and
- vi. Survey and design submissions for the Engineer's approval prior to commencing construction.

Most contractors have also been slow to submit "As-Built" drawings and resulting applications for "Statement at Completion".

#### 1. Road Contracts

##### Package 1

Name	
Address	
Contract No.	
Scope of Work	
Start Date	
Construction Period	
Construction Cost	
Opinion on overall construction performance	The contractor's performance is considered to be unsatisfactory due to delay, noncooperation in fighting claims, refusing to rectify damaged DBST for months before starting the rectification work
Opinion on routine maintenance performance	Some inadequate attempt has been made, but no effective routine maintenance has been done.

##### Package 2

Name	
Address	
Contract(s)	
Scope of Work	
Start Date	
Construction Period	

Construction Cost	
Opinion on overall construction performance	Overall performance is considered unsatisfactory.
Opinion on routine maintenance performance	Not relevant as terminated.

## Appendix 11

### PROJECT IMPLEMENTATION CONSULTANT SUMMARY

Following selection by competitive bidding (Technical and Financial Proposals) the Contract Agreement for Consultancy Services for Project Implementation Consultant for .....Province between the Ministry of Local Government and Provincial Councils and .....Pty Ltd Australia, in association with..... (Pvt.) Limited Sri Lanka and..... (Pvt.) Limited Sri Lanka was signed in December..... for a Commencement Date of 01 January.....

..... consultants of Korea in association with..... (Pvt.) Ltd of Sri Lanka signed the consultancy agreement on 21 December ..... having a commencement date .....

The PIC Inception Report was submitted on 24 February ..... and has been followed by regular Monthly Reports.

Monthly Progress Review Meetings are held monthly with each Contractor at which the Provincial Road Development Department is represented.

The PIC Project Office (Team Leader, Resident Engineer and key personnel) were located in..... In January 20..... the consultant's full-time Team Leader and the project office were relocated to ..... at No 50 of..... lane,..... road, .....

The PIC role is to supervise the day-to-day civil works on site, and in particular:

- ensure that all works are undertaken according to the provisions of the contracts,
- monitor the completion of the Project within the agreed program, budget, quality standards and environmental provisions stipulated in the contracts,
- monitor compliance with the environmental and social mitigation requirements of the civil works contracts,
- advise the EA on matters concerning implementation of the contracts, and
- provide training to counterpart staff in construction supervision.

Although the road maintenance component commenced during the original .....months Consultancy period, it will continue on after the consultancy supervision services have been completed. Management and monitoring procedures have been prepared and training provided to PRDD staff to continue the management of these road maintenance inputs after demobilization of the PIC. Mr. M was recruited as specialist for maintenance work and the payment and inspection were done on his guide lines. Later he was absorbed to the consultancy and the contractor were made aware of short comings and improvements needed

All payment for maintenance was done by the PRDD without any certification from the PIC.

Members of the national team, including the Resident Engineer, Technical Specialists, Assistant Resident Engineers, Technical Officers and office support staff were mobilized as required, as shown in the table following.

The PIC also engaged the services of..... from November 20..... to January 20..... to prepare the Project Performance Management System and provide training to PRDD, under a variation to the consultancy contract.

The original consultancy period of..... months was based on completion of construction work by March..... Delays in awarding of contracts, implementation, and additional contracts have resulted in Variations extending the consultancy duration to January 20..... – a total of.....months.

As the .....project commenced from 29 January..... the consultancy work for projects both incomplete and new, were done under the PIC; but payments were made under..... agreement with PIC and the variations of man months

The original consultancy contract value was \$. ..... and LKR..... By careful management and reallocation of provisions where possible, the final consultancy cost inclusive of additional services and extended duration is \$...... and LKR ....., which is a saving of ....% in \$ component and modest increase of.....% in LKR component. One variation order for increase in man months for the extended period had been approved to cover the increase in LKR component

#### **PIC STAFF ALLOCATION**

<b>Position</b>	<b>Name</b>	<b>From</b>	<b>To</b>
Team Leader			
Resident Engineer/Acting team Leader [at times]			
Quantity Surveyor 1 & 2			
Environmental Specialist			
Resettlement Specialist			
Pavement / Materials Engineer			
Strucxtural/ Bridge Engineer			
Highway Engineer 01			
Highway Engineer 02			

Social /Gendert Specialist/ PPSM specialist			
CAD Operators			
Secretary			
ARE P01			
ARE P02			
ARE P03			
Technical Officers			
Support Staff			



## Appendix 12

### PROVINCIAL ROADS IMPROVEMENT PROJECT –..... PROVINCE

#### INVESTMENT (COST) PLAN

##### A. Comparison of Investment Plans in RRP and PAM

Item			RRP Table 1	PAM Annex 6, Table 6.1					
			Amount	Total Cost	ADB	GoSL	ADB (%)	GoSL (%)	Cost Share (%)
A.	Base / Investment Cost <sup>a</sup>								
	1.	Road and Bridge Improvement / Civil Work	52.	53.12	53.12	0.00	100.0	0.0	68.1
		a. .... Province <sup>b</sup>		26.72	26.72	0.00	100.0	0.0	34.3
		b. .... Province		26.40	26.40	0.00	100.0	0.0	33.8
	2.	Consultants	5.20	5.20	5.20	0.00	100.0	0.0	6.7
		a. ....Province		2.60	2.60	0.00	100.0	0.0	3.3
		b. .... Province		2.60	2.60	0.00	100.0	0.0	3.3
	3.	Equipment	1.00	0.20	0.20	0.00	100.0	0.0	0.3
	4.	Taxes and Duties <sup>c</sup>	8.00	8.00	0.00	8.00	0.0	100.0	10.3
	Subtotal A			66.52	58.52	8.00	88.0	12.0	85.3
B.	Recurrent Costs – Project Management <sup>d</sup>		1.00						
	1	Project Coordination Unit		0.20	0.20	0.00	100.0	0.0	0.3
	2.	.....Province		0.40	0.40	0.00	100.0	0.0	0.5
	3.	..... Province		0.40	0.40	0.00	100.0	0.0	0.5

		<b>Subtotal B</b>		<b>1.00</b>	<b>1.00</b>	<b>0.00</b>	<b>100.0</b>	<b>0.0</b>	<b>1.3</b>
<b>C.</b>		<b>Contingencies<sup>e</sup></b>	<b>7.00</b>						
	1.	Physical Contingencies <sup>f</sup>		4.98	4.98	0.00	100.0	0.0	6.4
	2.	Price Contingencies <sup>g</sup>		2.69	2.69	0.00	100.0	0.0	3.4
		<b>Subtotal C</b>		<b>7.67</b>	<b>7.67</b>	<b>0.00</b>	<b>100.0</b>	<b>0.0</b>	<b>9.8</b>
<b>D.</b>		<b>Interest During Implementation<sup>h</sup></b>	<b>3.0</b>	<b>2.81</b>	<b>2.81</b>	<b>0.00</b>	<b>100.0</b>	<b>0.0</b>	<b>3.6</b>
		<b>Total</b>		<b>78.00</b>	<b>70.00</b>	<b>8.00</b>	<b>89.7</b>	<b>10.3</b>	<b>100.0</b>

<sup>a</sup> In early 20..... prices.

<sup>b</sup> Includes road and bridge improvement and..... Provincial Road development  
Department office building improvement.

<sup>c</sup> Computed at 12% for civil works contract values, foreign consultant remuneration, and equipment.

<sup>d</sup> Incremental administrative expenditures, including imprest account bank charges.

<sup>e</sup> For RRP Investment Plan - Physical contingencies computed at 10% for civil works and consulting services. Price contingencies computed at 2.4% on foreign exchange costs and 7% on local currency costs.

<sup>f</sup> For PAM Estimate – Computed at 10% for civil works contract and consulting services contract values.

<sup>g</sup> For PAM Estimate – Computed at 2.4% for foreign exchange costs and 7% for local currency costs.

<sup>h</sup> For RRP Investment Plan – Includes interest during construction; for PAM Estimate – At 1% during the grace period (8 years).

**Actual Investment Details based on interim.....Province accounts records to 31 July 20.....prior to completion of all final project payments.**

Item			Total Cost	ADB	GoSL	ADB (%)	GoSL (%)	Cost Share (%)
<b>A.</b>	<b>Investment Costs</b>							
	1.	Civil Works						
		a. .... Province	26.9	26.9	0.000	100.0	0.0	78.9
		b. .... Province						
	2.	Consultants						
		a. .... Province	2.7	2.7	0.000	100.0	0.0	8.1
		b. .... Province						
	3.	Equipment	0.000	0.000	0.000	100.0	0.0	0.0
	4.	Taxes and Duties	4.0	0.000	4.0	0.0	100.0	11.9
		<b>Subtotal (A)</b>	<b>33.0</b>	<b>29.0</b>	<b>4.0</b>	<b>88.0</b>	<b>12.0</b>	<b>98.9</b>
<b>B.</b>	<b>Recurrent Costs – Project Management</b>							
	1.	Project Coordination Unit						
	2.	..... Province	0.3	0.3	0.000	100.0	0.0	1.1
	3.	..... Province						
		<b>Subtotal (B)</b>	<b>0.3</b>	<b>0.3</b>	<b>0.000</b>	<b>100.0</b>	<b>0.0</b>	<b>1.1</b>
<b>C.</b>	<b>Contingencies</b>							
	1.	Physical Contingencies						
	2.	Price Contingencies						
		<b>Subtotal (C)</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>
<b>D.</b>	<b>Interest During Implementation</b>		<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>100.0</b>	<b>0.0</b>	<b>0.0</b>
		<b>Total Project Cost (A+B+C+D)</b>	<b>34.0</b>	<b>30.0</b>	<b>4.0</b>	<b>88.1</b>	<b>11.9</b>	<b>100.0</b>

## **Appendix 13**

### **REPORT OF THE PROJECT PERFORMANCE MANAGEMENT SYSTEM (PPMS) STUDY ON PROJECT ROADS IN THE ..... PROVINCE**

xPD office should do this!!

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#### **CONTENTS**

- V. Project Description
  - E. Objectives
  - F. Components
  - G. Implementation Methods
  - H. Description and Justification of Changes
- VI. Project Implementation
- VII. Initial Operations
- VIII. Evaluation of the Asian Development Bank's Performance

#### **Appendices**

- 12. Project Design and Monitoring Framework
- 13. .... Province Contract Packages
- 14. .... Province Project Management Organization Structure
- 15. .... Province ADB Missions and Project Coordination Meetings
- 16. .... Province Contract Implementation Chart
- 17. ....Province Contract Implementation Details
- 18. Individual Contract Summary Sheets
- 19. Individual Contract Quality Assurance Summaries
- 20. Bill No.8 Routine Maintenance Road Contract Provisions
- 21. Contractor Performance Assessments
- 22. PIC Summary
- 23. Provincial Roads Improvement Project –..... Province, Investment (Cost) Plan
- 24. Report of the Project Performance Management System (PPMS) Study on Project Roads in the..... Province

#### **Figures**

- 2. Site Map for..... district Projects
- 3. Site Map for ..... district Projects

## **Annexure – 5 - A sample Sub Project Completion Report**

## **A sample Sub Project Completion Report**

### **A Photograph of site**

**..... Funded Project, under ..... Development Programme.**

**Managed by:**

### **Introduction**

Rehabilitation and Improvement of 14.220 Km length of .... Road from A to B and additional 310 m length on ... Road from C to D junction was commenced on 1<sup>st</sup> December/ x using the ..... fund under ..... Development Projects under the Ministry of .....

The above Development Programme provides benefits to every segment of the society in a justifiable manner, creating avenues to enable people to engage in gainful economic activities since it will result in reducing vehicle operating costs and travel time. Improvement of this road improves the mobility from A to B which connects P and Q of .... district. Also reduce the travel time for people travelling from Colombo, to E.

### **Summary of the Project**

Employer	: Ministry of .....
	..... Development Programme
Engineer	: ..... Consultants (Pvt) Ltd
Contractor	: ..... (Pvt) Ltd
Contact Amount	: Rs. 1,000,000,000 (without VAT)
Time for Completion	: 730 Calendar days

Date of Commencement : 1<sup>st</sup> of December x  
Contract Date of Completion : 29<sup>th</sup> November x+2  
EOT Approved : 170 days  
EOT No.1 - 56 days  
EOT No.2 - 114 days  
Approved Revised Completion Date : 18<sup>th</sup> May x+3

### **Scope of Work**

The work shall be comprised on improvement and rehabilitation of following road sections by widening to 6.4 carriageway width, 0.6 m hard shoulder and 0.6-1.2 m soft shoulder relocation of utility services wherever necessary.

- ..... Road Section from A to B from 0+000 Km to 14+300 km)
- ..... road last 0.310 km section

The road construction works are included for

- Demolishing and rebuilding of structures and obstruction.
- Earth works, sub base and base preparations.
- Asphaltic concrete overlay and reconstruction of pavements.
- Providing of hard shoulder and soft shoulder.
- Construction of roadside and lead-away drains where ever required.
- Construction and extension of reinforced concrete box culverts, pipe culverts.
- Provision of kerbs, bus-bays and a bus-shelters.
- Road furniture,

There will be relocation of telecom post, electrical post and water pipe in small section with improvement of the road and associated works.

### **Quality Aspects**

The Contractor performed all the construction activities as per the approved Method Statement and maintained the quality as per approved Quality Assurance Plan.

In this project, documents like RFI, Check lists, Material Test Reports and etc., were prepared and inspected and/or witnessed jointly with consultant officials as per Inspection Test Plan approved by the Engineer.

In addition to that, dedicated site laboratory with all necessary equipment for material testing was available in the Contractor's site office premises.

In total, 25 NCRs were raised and the Contractor rectified the shortfalls as per the Corrective Action Plans approved by the Engineer. Accordingly, all NCRs are closed now.

### **Health and Safety**

Since the beginning of the Project, the Contractor complied with the provisions of Traffic and Safety Manual which is part of the agreed Contract between the Parties. The Engineer .....Ltd. supervised and ensured the implementation of Traffic and Safety procedures stipulated under the Contract to ensure the safety of the Public as well as the personnel attached with this Project.

Environmental and Social Impact Assessments (ESIA), including Environmental and Social Management Plans (ESMP) has been prepared for this Project. All safeguards documents include measures for mitigating the Occupational Health and Safety (OHS) related risks. The ESMP insists that workers should be trained to recognize potential hazards and use safe work practices.

Only one fatal accident was encountered during the whole project duration.

### **Commercial and Contracts**

Advance Payment of Rs. 200,000,000, which is 20% of the Contract Value was paid in accordance with the Contract provision. The recovery of Advance Payment commenced in IPC No.12 and entire Advance Payment was recovered by IPC No.28.

Retention of Rs. 56,000,000.00 which is 20% of the Contract Value has been retained in accordance with the Contract provision and 50% of such amount shall be released in the IPC No.31 which is last IPC for the work done during the May x+3.

### **Payment Certificates**

Following is the status of Payments as of 22<sup>nd</sup> June x+3.

IPC NO.	Contractor Submission	Engineer's Recommendation	Release of Payment
1	x	x	x
2	x	x	x
3	x	x	x
4	x	x	x
5	x	x	x
6	x	x	x
7	x	x	x
8	x	x	x
9	x	x	x
10	x	x	x
11	x	x	x
12	x	x	x
13	x	x	x
14	x	x	x
15	x	x	x
16	x	x	x
17	x	x	x



18	x	x	x
19	x	x	x
20	x	x	x
21	x	x	x
22	x	x	x
23	x	x	x
24	x	x	x
25	x	x	x
26	x	x	x
27	x	x	x
28	x	x	x
29	x	x	
30	x	x	
31 (Last IPC – for the Month of May x+3)	x	Under review	
Statement at Completion	Preparation		

### Variations

VO No.	Engineer's Recommendation	Employer's Approval
1	x	x
2	x	x
3	x	x
4	x	x
5	x	x
6	x	Under review
7	x	x
8	x	x
9	x	x

### Claims

Apart from the Claim for Extension of Time for Completion, following Cost Claims are encountered.

1. **Interest for Late Payment** - Engineer issued its opinion to the Employer. In the Engineer's opinion, the Contractor has to resubmit the Claim taken into account the benefit they enjoyed as the Employer released the payment without IPC reaching the Minimum Value to support the Contractor. The Contractor is entitled for the amount difference between the Contractor's financial losses due to late payment and the financial benefit they gained due to release of the payment without IPC reaching the Minimum Value in few occasions.

2. **Idling Cost Claim for shutdown of site activities for 1 day due to Hartal** – Approved by the Employer based on the Engineer's recommendation.
3. **Prolongation Cost for the Extended Project Period** – The Contractor has submitted the Prolongation Cost Claim – Part 1 for the additional cost incurred during the extend Contract duration. In this Part 1 submission, Contractor considered the Items in the BOQ Bill No.1 (Preliminaries) which cost get affected by the duration of the Project (Time Related Items only).

### **Time for Completion**

The Time for Completion of the Project has been extended up to 18<sup>th</sup> May x+3 from the original Completion Date of 29<sup>th</sup> November x+2. These 170 days of Extension of Time was approved via EOT No.1 – 56 days and EOT No.2 – 114 days.

EOT No. 1 was approved for Extension of Time for Completion by 56 days and the completion date was revised to 24<sup>th</sup> January x+3 from 29<sup>th</sup> November x+2. The EOT No. 2 was approved for Extension of Time for Completion by 114 days and revised completion the completion date was revised to 18<sup>th</sup> May x+3 from 24<sup>th</sup> January x+3.

Extension of Time for Completion of the project was approved due to several reasons as COVID19 pandemic, Delay in Design, Variation, Adverse Weather Condition, Shutdown of Site activities due to Hartal, and x+2 Parliamentary Election

The Contractor substantially completed the project on the revised completion date except few minor outstanding works those were completed later on during the Defect Notification Period.

### **Project Closeout**

As the Project has been successfully completed on the revised Completion date, now the Contractor and the Engineer jointly verify the final quantities to finalize the Statement of Completion. As per the Contract the Statement of Completion shall be submitted by the Contractor within 86 days from the Project Completion date.

Also, the Contractor started to submit the As-built drawings part by part and the same are being reviewed by the Engineer in parallel to avoid last minutes hassles. Accordingly, within 86 days from the Completion Date, the As-built drawings shall be submitted along with the Statement of Completion. The Engineer verified and certified documents shall be forwarded to the Employer.

### **Operation Manual [for Traffic Signal]**

The Traffic Signal at A junction is only electromechanical component in the Project. The operation and maintenance aspects were explained to the technical staff of the RDA Executive Engineer ..... Office. The timing of the signal can be adjusted later depend on the traffic flow pattern if necessary.